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JUMPING PLANT LICE OF THE TRIBE CIRIACREMINI (HOMOPTERA : PSYLLOIDEA) IN THE ETHIOPIAN REGION

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D. HOLLIS

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JUMPING PLANT LICE OF THE TRIBE CIRIACREMINI (HOMOPTERA : PSYLLOIDEA) IN THE ETHIOPIAN REGION

BY
DAVID HOLLIS

Pp. 1–83; 191 *Text-figures*

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In 1965 *a separate supplementary series of longer papers was instituted, numbered serially for each Department.*

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JUMPING PLANT LICE OF THE TRIBE CIRIACREMINI (HOMOPTERA : PSYLLOIDEA) IN THE ETHIOPIAN REGION

By D. HOLLIS

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SYNOPSIS

An historical account of the taxonomy and nomenclature of the group called here the tribe Ciriacremini is given. The tribe Ciriacremini is redefined, its internal phylogeny briefly discussed and a key is given to the five genera included. In the Ethiopian region 30 species in three genera are recognized and keys are given to all these taxa. One genus and 21 species are described as new and the remaining taxa are redefined. Three new generic synonyms and three new combinations are proposed, and four species are replaced in their original combinations.

INTRODUCTION

THE psyllid faunas of the tropics, subtropics and the south temperate region are poorly known and that of the African continent is no exception. Currently 92 described species are known from Africa, south of the Sahara, but recent collecting in the region would suggest that this figure represents only a small proportion of the existing fauna. For example, prior to the author's recent field trip to East Africa, nine described species of Psylloidea had been recorded in the literature from the area, yet on this visit approximately 90 species were collected and most of these appear to be undescribed.

Psylloidea can transmit plant viruses, are pests of fruit, ornamental and timber trees, and one species is known to have developed resistance to several insecticides (McMullen & Jong, 1971). Research on the systematics of the group is of increasing interest to foresters and economic entomologists and the need for some alpha-taxonomic studies on tropical faunas is abundantly clear. Some such work was begun by Karel Vondracek in the last decade shortly before his death. Capener (1968; 1970*a*; 1970*b*; 1973) produced some useful work on the South African fauna but he has now retired leaving a large collection of unworked material.

About 15% of the material recently collected from Africa consists of specimens in which the fore wing bears a clearly developed *rm* crossvein, suggesting they are related to Enderlein's genus *Ciriacremum*. As much of this material represents undescribed taxa, a taxonomic study of the African Ciriacremini is given below. Prior to this work the group was thought to be a tribe in the subfamily Psyllinae containing, worldwide, five monobasic genera, a genus with four species and a genus with two species. The current work, based on a study of over 2,250 specimens, agrees with the systematic position of the group but rearranges the Ethiopian constituents into one new monobasic genus, a genus with six species, two of which are new, and a genus with 23 species, 18 of which are new. The New World component of the group, three species in three genera, is not considered here to any depth because only five specimens were available for study.

HISTORICAL

Enderlein (1910*b*) first used the name Ciriacreminae as a replacement name for Prionocnemidae Scott, 1882, pointing out that Scott's name was invalid as it was not derived from a generic name in the group to which it was applied. Scott included two genera, *Carsidara* and *Tyora*, in his group, and Prionocnemidae was used in various derivations by Löw (1886), Froggatt (1901), Kieffer (1906) and Kuwayama (1907). None of these authors widened the scope of the group. Kieffer (loc. cit.) erected the subfamily Phacoseminae for two genera *Phacosema* and *Phacopteron*, and Kuwayama (loc. cit.) placed the genus *Anomoneura* into the Phacoseminae. Enderlein considered this group to be a tribe in the Ciriacreminae.

Enderlein's principal character defining the Ciriacreminae is the presence of an *rm* crossvein between the radial sector (*Rs*) and the upper branch of the medial vein (M_{1+2}) or the punctiform contact between *Rs* and M_{1+2}. He divided the subfamily into two tribes, the Ciriacremini and the Phacosemini, on the presence or absence of a basal spine on the hind tibia. In the former tribe he placed the genera *Ciriacremum*, *Panisopelma*, *Tyora*, *Carsidara* and *Udamostigma*, and in the latter tribe he placed *Phacosema* and *Phacopteron*. These two latter genera were tentatively synonymized by Crawford (1912) and Laing (1930) confirmed the synonymy. Aulmann (1912*b*) added *Kleiniella* to the Ciriacremini and, in his psyllid catalogue (Aulmann, 1913), included the following genera in the Ciriacreminae: *Carsidara*, *Kleiniella*, *Tyora*, *Geyerolyma*, *Panisopelma*, *Ciriacremum*, *Phacosema*, *Phacopteron*, *Anomoneura*, *Udamostigma* and *Nesiope*. Šulc (1914) erected

Connectopelma as a subgenus of *Panisopelma* and Enderlein (1927) further added the genus *Desmiostigma* to the group.

Crawford (1911) seems to have partly misunderstood Enderlein's work for, although agreeing that Prionocnemidae Scott was an invalid name, he also rejected Ciriacreminae Enderlein for a spurious nomenclatural reason. However, he quite rightly pointed out that Enderlein's subfamily was a rather heterogeneous mixture of unrelated genera and went on to define a subfamily, the Carsidarinae, containing the following genera: *Carsidara*, *Tyora*, *Mesohomotoma*, *Tenaphalara*, *Macrohomotoma*, *Epicarsa*, *Freysuila*, *Homotoma*, *Bactericera* and *Rhinopsylla*. Later (Crawford, 1914) he partially accepted Enderlein's subfamily, using the name 'Ceriacreminae' for two New World species. Also in that paper Crawford suggested the 'Ceriacreminae' were probably most closely related to the Psyllinae.

Heslop-Harrison (1958), in his reorganization of the classification of the Psylloidea, went to considerable lengths to sort out the nomenclatural complications revolving around the Ciriacreminae but then proceeded to introduce several taxonomic complications. He used the Ciriacreminae in a very broad sense to include the old Ciriacreminae of Enderlein and the Carsidarinae of Crawford, and many other groups of genera in what amounted to a ragbag subfamily for those genera he could not place in the other subfamilies, i.e. Liviinae, Aphalarinae, Psyllinae, Spondyliaspinae and Triozinae. He split the subfamily into seven tribes including the Ciriacremini and Carsidarini. In the former tribe he placed the genera *Ciriacremum*, *Bunoparia*, *Kleiniella*, *Panisopelma*, *Connectopelma* and *Anomalopsylla*. At no point in this paper did Heslop-Harrison clearly define the Ciriacreminae but in the key to tribes the Ciriacremini were stated to have '. . . venation not triozine, antennae long and slender. Fore wing with a distinct tracheate *rm* crossvein or with *Rs* and M_{1+2} closely approximating. Head not cleft in front'. In a later paper (Heslop-Harrison, 1960) he mentions that members of both the Carsidarini and the Ciriacremini have a bipartite male proctiger, secondary terminal epiphyses ('Sternalzapfen' of Enderlein, 'Hypovalves' auctt.) in the male, and an *rm* crossvein or with *Rs* and M_{1+2} closely approximating. He distinguished the latter group by the non-cleft head, the 'usual' development of genae and the 'normal' insertion of the antennae.

Vondracek (1957) in his figure 52 obviously considered the Ciriacreminae in a more restricted sense, possibly that of Crawford, and placed the group close to the Psyllinae and Arytaininae. Later (Vondracek, 1963) he described the monobasic African genus *Syndesmophlebia*, placed it in the Ciriacreminae and differentiated it from *Ciriacremum*, *Anomoneura*, *Bunoparia*, *Panisopelma* and *Connectopelma*. Also in that paper (Vondracek, loc. cit.) he erected the tribe Anomalopsyllini within the Spondyliaspinae for the Australian genus *Anomalopsylla*. Klimaszewski (1963) erected a separate tribe Anomoneurini for the Asian genus *Anomoneura* because of the multiple branching of *Rs* in the fore wing of the two known species. Both Klimaszewski (1964) and Bekker-Migdisova (1973) in their classifications of the Psylloidea placed the Ciriacreminae in the family Psyllidae. The latter author separates the group from other members of the family Psyllidae on the presence of an *rm* crossvein or contact between *Rs* and M_{1+2}, a bipartite male proctiger and the presence, in some species, of rudimentary genal cones. She further separates the group into two tribes, the Ciriacremini and the Anomoneurini, and distinguishes the former by the absence of a pectinate *Rs* and the presence of more or less developed hypovalves on the male subgenital plate.

MATERIAL, METHODS AND TERMINOLOGY

Most of the material studied in this work was collected in the last twenty years by a number of field entomologists working in various parts of Africa. Principals among these are Drs José Passos de Carvalho and Tony van Harten in Angola, Laurie Capener in South Africa, Professor J. T. Medler in Nigeria, Dr V. F. Eastop in West and East Africa, and the present author in South-western, Central and East Africa. The bulk of this material is now incorporated into the collections of the British Museum (Natural History). The collections of the Central African Museum, Tervuren, and the National Collection of Insects, Pretoria, provided valuable additional material.

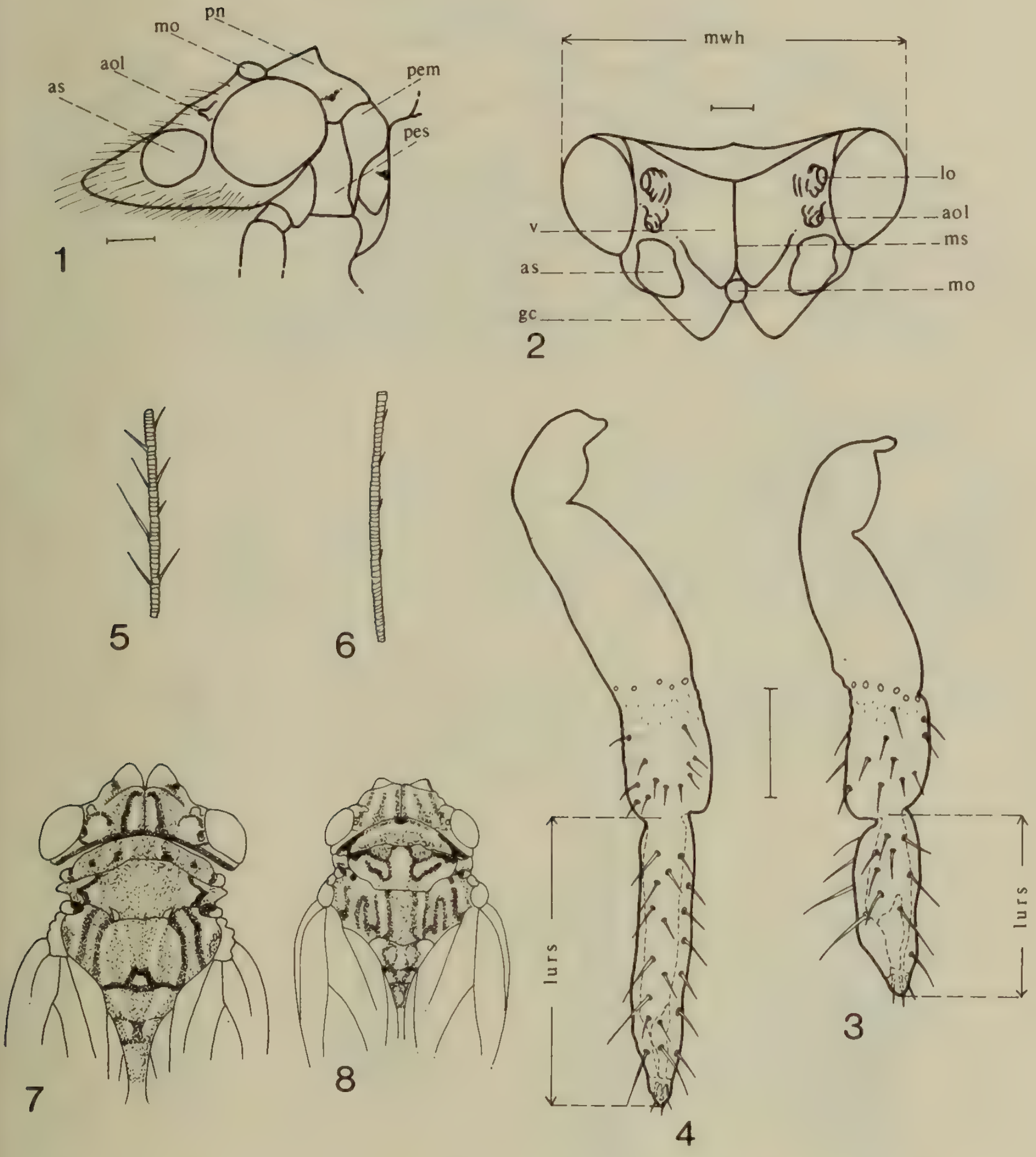
Type-depositories are given in the text below in abbreviated form as follows.

MNHU, Berlin	Museum für Naturkunde der Humboldt-Universität, Berlin.
SAM, Cape Town	South African Museum, Cape Town.
IPK, Eberswalde	Institut für Pflanzenschutzforschung Kleinmachnof, Eberswalde.
ZI, Leningrad	Zoological Institute, Academy of Sciences of USSR, Leningrad.
BMNH, London	British Museum (Natural History), London.
NCI, Pretoria	[National Collection of Insects] Plant Protection Research Institute, Pretoria.
NM, Nairobi	National Museum, Nairobi.
NR, Stockholm	Naturhistoriska Riksmuseum, Stockholm.
MRAC, Tervuren	Musée Royal de l'Afrique Centrale, Tervuren.
IZPAN, Warsaw	Instytut Zoologiczny, Polska Akademia Nauk, Warsaw.
USNM, Washington	National Museum of Natural History, Washington.

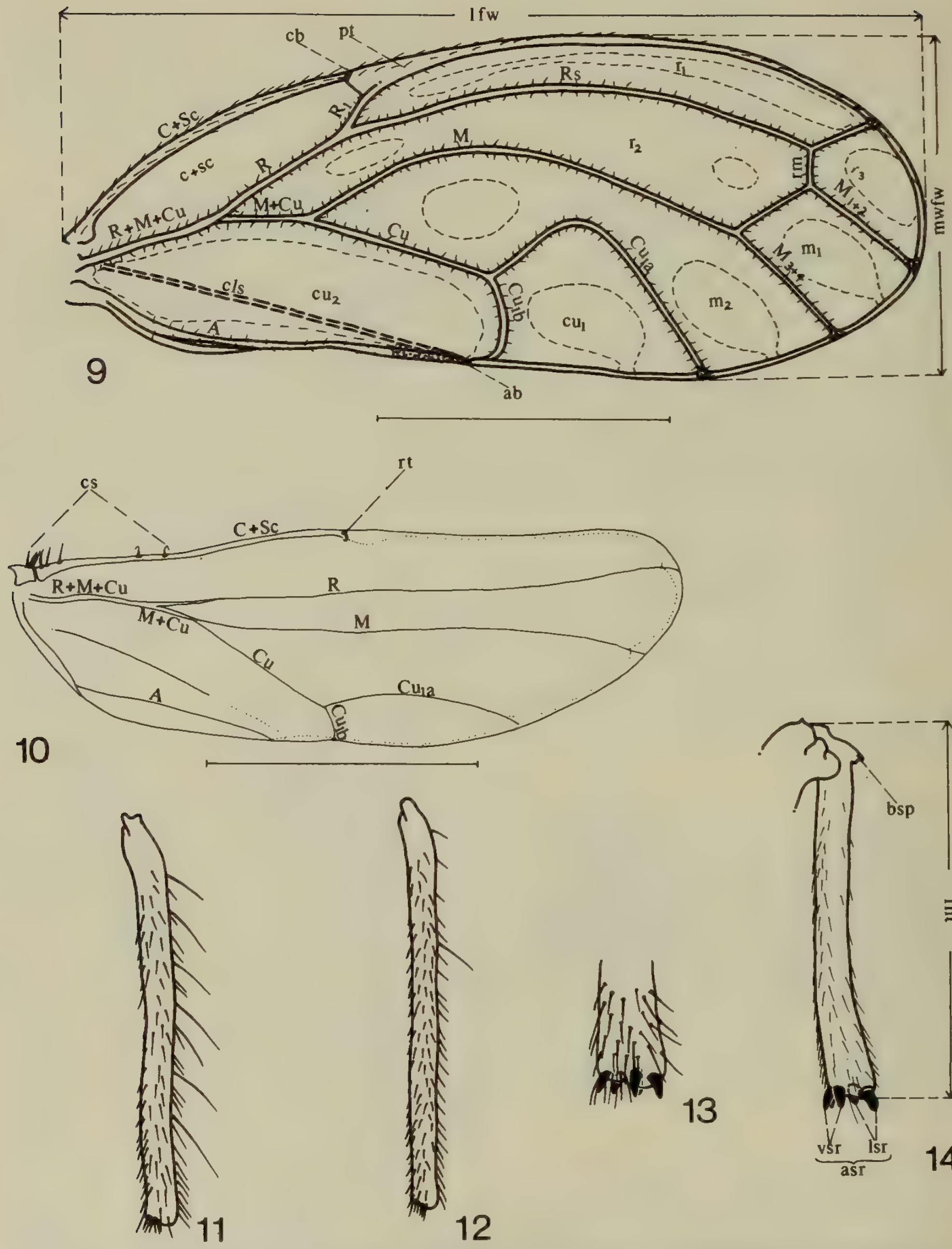
The material is stored dry (on card points or micropins), in 80% ethanol, or as permanent microscopical preparations on glass slides in a modified Berlese mountant. It was found necessary to make these preparations in order to study antennal structure, wing chaetotaxy and genital structures.

All measurements quoted below were made from slide mounted material. The reference points within which measurements were taken of the various structures are shown in Text-figs 2–4, 9, 14 and 19.

Structural terminology (Text-figs 1–19) used follows that of Vondracek (1957) and Dobreanu & Manolache (1962). One point where I differ from previous authors, e.g. Crawford and Vondracek, is in the use of the terms 'spur' and 'spine', particularly in relation to the hind tibia. In this paper the term 'spine' is used for a prolongation of the cuticle which does not have an articulated base (Text-fig. 14), and 'spur' is used for a structure with an articulated base and is a derived seta (Text-figs 13, 14). Thus the structure at the base of the hind tibia is called a spine and those at the apex are spurs, exactly the opposite to the previous nomenclature of these structures in Psylloidea.



FIGS 1–8. Ciriacremini species, morphological features. *Palmapenna hymenostegioides*, 1, head and prothorax, lateral view. *Ciriacremum bicaudatum*, 2, head, dorsal view; 6, seventh antennal segment; 7, head and thorax, dorsal view. *Kleiniella jassina*, 3, rostrum; 5, seventh antennal segment. *C. filiverpatum*, 4, rostrum. *C. africanum*, 8, head and thorax, dorsal view. (aol – anteoccipital lobe; as – antennal socket; gc – genal cone; lo – lateral ocellus; lurs – length of ultimate rostral segment; mo – median ocellus; ms – median suture; mwh – maximum width of head; pem – proepimeron; pes – proepisternum; pn – pronotum; v – vertex.) Scale line represents 0·1 mm.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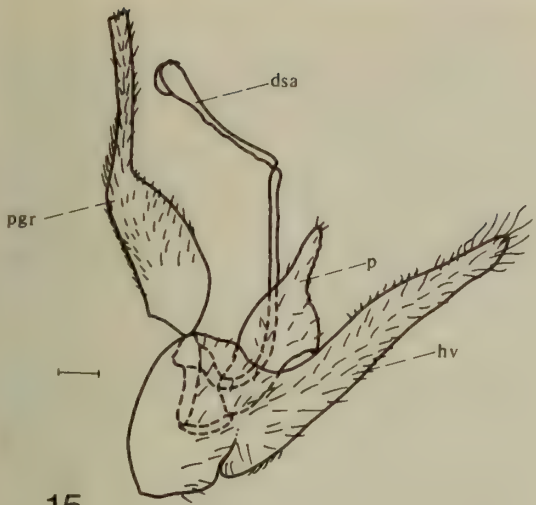
14

FIGS 9–14. Ciriacremini species, morphological features. *Ciriacremum bicaudatum*, 9, fore wing; 10, hind wing; 14, hind tibia. *Kleiniella jassina*, 11, fore tibia. *C. pervatum*, 12, fore tibia. *K. superba*, 13, apex of hind tibia. (*A* – anal vein; ab – anal break; asr – apical spurs; bsp – basal spine; *C* – costa; *c* – costal cell; cb – costal break; *cls* – claval suture; cs – costal setae; *Cu* – cubital vein; Cu_{1a} – first cubital branch; Cu_{1b} – second cubital branch; cu_1 – first cubital cell; cu_2 – second cubital cell; lfw – length of fore wing; lht – length of hind tibia; lsr – lateral spurs; *M* – medial vein; M_{1+2} – combined first and second medial branch; M_{3+4} – combined third and fourth medial branch; m_1 – first medial cell; m_2 – second medial cell; mwfw – maximum width of fore wing; *R* – radial vein; R_1 – first radial vein; *Rs* – radial sector; r_1, r_2, r_3 – first, second and third radial cells; *rm* – radio-medial cross-vein; rt – retinaculum; vsr – ventral spurs;



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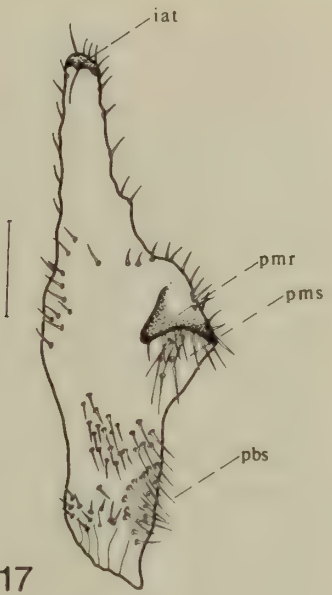

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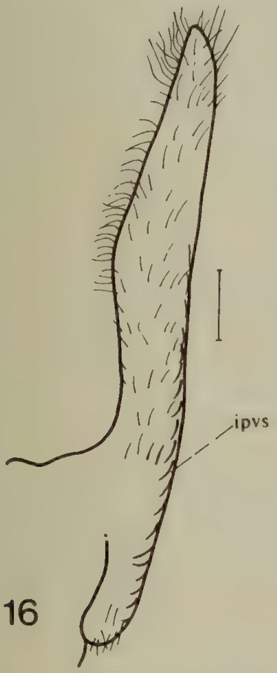

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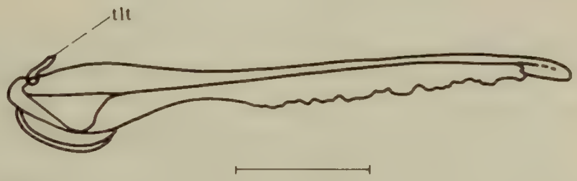

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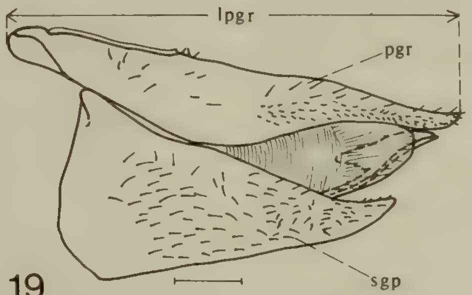

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FIGS 15–19. *Ciriacremum* species, morphological features. *C. bicaudatum*, 15, male genitalia, lateral view; 16, male hypovalve, lateral view of inner surface; 17, male paramere, lateral view of inner surface; 18, distal segment of aedeagus. *C. africanum*, 19, ovipositor, lateral view. (dsa – distal segment of aedeagus; hv – hypovalve; iat – inner apical tooth; ipvs – inner postero-vertical setae; lpgr – length of proctiger; p – paramere; pbs – postero-basal setae; pgr – proctiger; pmr – postero-medial ridge; pms – postero-medial setae; sgp – subgenital plate; tlt – terminal tube.) Scale line represents 0·1 mm.

ACKNOWLEDGEMENTS

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The following colleagues are acknowledged for their help with loans of type-, and other, material for study: A. L. Capener, formerly of the Plant Proctection Research Institute, Pretoria; Dr José Passos de Carvalho and Dr A. van Harten of the Instituto de Investigacao Agronómica de Angola; Dr U. Göllner-Scheiding of the Museum für Naturkunde der Humboldt-Universität, Berlin; E. Holm and E. Hartwig of the Plant Protection Research Institute, Pretoria; Paul D. Hurd Jr, of the National Museum of Natural History, Washington; Dr T. Kronestedt of the Naturhistoriska Riksmuseet, Stockholm; Professor J. T. Medler, formerly of the University of Ile-Ife, Nigeria; Dr J. Nast, of the Polish Academy of Sciences, Warsaw; Miss L. M. Russell, formerly of the United States Department of Agriculture, Maryland; and Dr G. Schmitz of the Central African Museum, Tervuren.

TAXONOMIC TREATMENT

Tribe **CIRIACREMINI**

Ciriacremini Enderlein, 1910*b* : 137, partim. Type-genus: *Ciriacremum* Enderlein.
Ciriacreminae Enderlein; Aulmann, 1913 : 79, partim.
Ceriacreminae Enderlein; Crawford, 1914 : 62.
Ciriacremini Enderlein; Heslop-Harrison, 1958 : 563, partim.
Ciriacremini Enderlein; Vondracek, 1963 : 273.
Ciriacremini Enderlein; Bekker-Migdisova, 1973 : 111.

Small to large size, head width 0·52–1·46 mm. Body robust or somewhat elongate. Head as broad as thorax and distinctly separated from thorax, in profile slightly depressed from axis of body; vertex wider than long with complete median suture, mostly clearly demarked from genae by transverse sutures, anteoccipital lobes mostly present; genae covering frons dorsally and either slightly bulbous or developed into cones. Antenna filiform to elongate filiform, rhinaria only present on segments four, six, eight and nine.

Thorax convex from above, arched in profile, pronotum mostly narrower than head; propleurites mostly subequal and both touching pronotum dorsally. Fore wing parallelogrammatic or ellipsoid; costal and anal breaks present, pterostigma mostly present, *rm* crossvein present or there is punctiform contact between Rs and M_{1+2}, M and Cu with common stem. Hind coxa with clearly developed meracanthus, hind tibia mostly with a well developed basal spine, hind basitarsus with a pair of apical spurs.

Male proctiger shaped to give broad basal part and narrow apical part which may be long or short, subgenital plate often with a pair of apical appendages (hypovalves).

Female proctiger and subgenital plate subconical, sometimes elongate, former often longer than latter.

Distribution, host plants and biology. The bulk of the known species are restricted to the Ethiopian region but three species apparently belonging to the tribe are recorded from Central and South America.

Much of the material studied was collected at light and only four species are known from larval stages as well as adults. Of the 30 known species in the Ethiopian region only nine have any recorded host data but these species were all found on trees of the leguminous family Caesalpiniaceae. There are no host records for the six species placed in the genus *Kleiniella* but all are known from both lowland and montane forest regions of Africa (Map 2). *Ciriacremum* species seem to have successfully exploited both forest and woodland areas, their typical habitat being the *Brachystegia* woodland zone in Central Africa (Maps 3–7). Recorded host genera for *Ciriacremum* are: *Brachystegia*, *Hymenostegia*, *Cynometra*, *Cassia*, *Julbernardia* and *Schotia* and the distribution of these genera in Africa is summarized in Map 1.

From personal observations it seems that only a few species of Psylloidea are attracted to light and their response to artificial light sources seems to vary considerably with their state of maturation. However, members of the Ciriacremini are frequently caught in light traps and Dr Passos de Carvalho, working in Angola, informs me in a personal communication 'I never saw so many Psyllidae attracted to light; here in Nova Lisboa thousands of these examples (*Ciriacremum*) came through my bathroom window and the bottom of the bath tub was almost covered with them'.

Table 1 is a summary of the numbers of specimens of six apparently sympatric species occurring in Central Africa in *Brachystegia* woodland. The material was collected in a variety of ways; on host plants, as vagrants, by yellow trays and light traps. From this table one can see the main period of adult activity takes place between August and December, roughly coincidental with the end of the dry season and the onset of the rains, with adults and larvae found on host plants between September and March. Although these data are very incomplete and the sampling not at all random it does suggest that *Ciriacremum* species in Central Africa have only one generation per year with a dry season diapause probably in a larval stage. It is of interest to note that from over 250 microscopical preparations of females, eggs were found in only five specimens.

The known larvae (Text-figs 24–27) are of the psylloid type, free living on the leaves and shoots of their host plants. They do not produce wax filaments and have little apparent affect on their hosts. Larvae of *Ciriacremum harteni* sp. n., occurring in large numbers on regenerating *Brachystegia tamarindoides*, were causing some leaf atrophy on young shoots.

Discussion. As mentioned earlier (p. 5) Bekker-Migdisova suggests that the Ciriacremini is the sister group of the Anomoneurini, a tribe with two species occurring in the Oriental region and probably developing on trees of the family Moraceae. As I have no evidence to the contrary this suggested phylogeny within the Ciriacreminae is accepted here but with reservations. The presence of an *rm* crossvein or the punctiform contact of *Rs* and M_{1+2} is considered here to be a derived feature in the modern Psylloidea and has developed independently several

TABLE I

Summary of biological data and numbers of specimens examined of six sympatric species of *Ciriacremum* in Central Africa (Zaire to Rhodesia).

SPECIES	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
filiverpatum on *Brachystegia* sp.					0♂, 1♀; lt	0♂, 2♀; lt		47♂, 63♀; lt	0♂, 1♀; lt 1♂, 2♀; yt	38♂, 48♀; lt	85♂, 7♀; lt 0♂, 2♀; lt (with eggs) 6♂, 8♀; oh (with eggs)	0♂, 1♀; lt
bicaudatum ? host								1♂, 0♀; lt	3♂, 0♀; lt 0♂, 2♀; yt	11♂, 11♀; lt	3♂, 2♀; lt	10♂, 16♀; lt
julbernardioides on *Julbernardia* spp.	6♂, 6♀, n; oh 3♂, 1♀; yt	13♂, 8♀; v	5♂, 2♀; v						3♂, 5♀, n; oh 1♂, 0♀; yt	3♂, 1♀, n; oh 36♂, 51♀; lt 1♂, 0♀; yt 1♂, 3♀; v	3♂, 3♀; yt	
africanum on *Cassia* sp.								5♂, 0♀; lt	18♂, 14♀; oh 14♂, 11♀; lt 4♂, 11♀; yt 1♂, 0♀; v	16♂, 38♀; lt 5♂, 0♀; yt 5♂, 14♀; v	18♂, 31♀; lt	
megafricanum ? host			0♂, 1♀; v					23♂, 44♀; lt 0♂, 1♀; yt	2♂, 0♀; yt 1♂, 2♀; v	24♂, 24♀; lt	47♂, 62♀; lt	
harteni on *Brachystegia* spp.		8♂, 6♀, n; oh	21♂, 15♀; oh (1♀ with eggs)			0♂, 1♀; yt		4♂, 14♀; oh	10♂, 14♀; yt	4♂, 2♀, n; oh 5♂, 5♀; yt		
Rainfall (mm)	118	117	115	90	35	3	0	20	52	65	88	127

Mean monthly rainfall figures for the whole area are given in base horizontal row.
lt = light trap, n = larva, oh = on host, v = vagrant, yt = yellow tray. For further explanation see text (p. 11).

times in the evolutionary history of the group. In the genera *Phacopteron* and *Pseudophacopteron* *Rs* and M_{1+2} make punctiform contact but on the structure of the head and thorax these genera are naturally placed near the Pauropsyllini in the Carsidaridae (Loginova, 1972). Also several other genera in the Carsidaridae, e.g. *Carsidara* and *Mesohomotoma*, possess an *rm* crossvein but in these genera it is of a different nature to that found in the Ciriacreminae. An *rm* crossvein is present in the New Zealand genus *Anomalopsylla* which is currently placed in the Spondyliaspinae (Vondracek, 1963). These examples are all from outside the family Psyllidae. Where the *rm* crossvein occurs within the Psyllidae its presence is used here to indicate monophyly and all species possessing this feature are placed in the Ciriacreminae. This usage must remain speculative until the functional significance of the presence of an *rm* crossvein is understood and other corroborative synapomorphic characters are found. Other authors (Klimaszewski, 1963; Bekker-Migdisova, 1973) use the apparently bipartite male proctiger to diagnose the group further but the latter author considers this feature to be primitive. If this is the case then it should not be given much weight when considering phylogeny.

In most Ciriacremini the male proctiger is subdivided into a broader basal part, which sometimes bears lateral lobes or expansions, and a narrower apical part which is often relatively long. It is not clearly bisegmented, as in *Phytolyma* or *Mesohomotoma*, and may not be a primitive feature. This kind of proctiger structure occurs widely in the Psylloidea but is not often as clearly developed as in the Ciriacremini.

Apart from the Ethiopian species, which are considered here, three other species are currently placed in the Ciriacremini and are distributed in the New World. *Panisopelma quadrigibbiceps* Enderlein, 1910*a*, was described from east-central Argentina, *P.* (*Connectopelma*) *conifrons* Sulc, 1914, from the other side of the Andes in central Chile, and *Ceriacremum setosum* Crawford, 1914, from Central America. In *Panisopelma* and *Connectopelma* the anteoccipital lobes are absent but the vertex, on either side of the median suture, is swollen to form a pair of lobes or humps, the basal spine of the hind tibia is very weak or absent and the male subgenital plate lacks hypovalves. If these two species share a common ancestry with the Ethiopian Ciriacremini, and this is open to doubt, their divergence from the Old World forms was early in the history of the group. The third New World species, *Ceriacremum setosum*, more closely resembles the Old World forms; the anteoccipital lobes are present and the vertex is unmodified, the basal spine of the hind tibia is strongly developed and the form of the male proctiger is similar to that of *Kleiniella medleri* sp. n. and *Ciriacremum capense* Enderlein.

KEY TO GENERA OF CIRIACREMINI

1 Vertex on either side of median suture swollen to form two clearly protruding lobes or humps (Text-fig. 28), anteoccipital lobes absent; basal spine of hind tibia very weak or absent. South America. ***PANISOPELMA*** and ***CONNECTOPELMA***

– Vertex not or hardly swollen on either side of median suture, anteoccipital lobes present (Text-figs 29–33); basal spine of hind tibia well developed. Ethiopian Region, Central America 2

2 Fore wing without a pterostigma, *Cu* curves forwards to touch *M* (Text-fig. 59) **PALMAPENNA** (p. 14)

– Fore wing with a pterostigma, *Cu* not touching *M* (Text-figs 51–56) . . . 3

3 Veins of fore wing with hairs which are more than twice as long as width of veins (Text-figs 51–58); hairs on antennal flagellar segments longer than width of pedicel (Text-fig. 5); fore wing usually patterned (Text-figs 51–58), pterostigma usually sessile but if pedunculate then wings clearly pigmented (Text-figs 57–58); male subgenital plate without hypovalves (Text-figs 96, 102, 108) **KLEINIELLA** (p. 15)

– Hairs on veins of fore wing usually short (Text-fig. 60), rarely longer than width of veins; hairs on antennal flagellar segments not longer than width of pedical (Text-fig. 6); fore wing usually hyaline (Text-fig. 61), pterostigma usually pedunculate (Text-fig. 62) but if sessile then wing hyaline; male subgenital plate usually with hypovalves (Text-figs 114, 126, 138) . . **CIRIACREMUM** (p. 24)

PALMAPENNA gen. n.

Type-species: *Palmapenna hymenostegioides* sp. n.

Description. Medium size, head width 0·64–0·78 mm. Integument shiny, with a moderately dense covering of long hairs. Head wider than pronotum, with vertex and genal cones in same plane as axis of body; vertex almost flat; genal cones not distinctly separated from vertex, completely covering frons dorsally; antenna filiform, flagellum two to two and a half times longer than maximum width of head, sparsely covered with short hairs; ultimate rostral segment slightly shorter than third antennal segment. Thorax, in profile, weakly convex, mesoscutellum raised medially into a blunt tubercle; propleurites subequal, both in contact with pronotum dorsally (Text-fig. 1). Fore wing rounded triangular, broadest distally; pterostigma absent, costal and anal breaks present, veins sparsely covered with long hairs on dorsal surface; *rm* crossvein present, long, *M* stem also in contact with *Rs* proximally and with Cu_1 distally, points where veins make contact or branch often marked by a sharp callus dorsally; costal setae of hind wing divided into two groups. Fore femur with a few longer setae antero-ventrally, fore tibia with four to five pairs of longer setae antero-dorsally; apical spurs of hind tibia not arranged to form a distinct ventral group.

Male subgenital plate without hypovalves; proctiger with short, narrow apical part and broad basal part which bears a pair of backwardly pointing lateral lobes.

Ovipositor short, simple, conical.

Discussion. The form of the fore wing in this genus is highly derived and it is very difficult to assess its ancestral type. The pterostigma is completely lacking, *M* curves in an unusual manner to make contact with both *Rs* and Cu_1, and the overall wing shape is unique among known psyllids. However, the *rm* crossvein is present and well developed and the veins bear long hairs similar to species of *Kleiniella*. The genal cones are not completely separated from the vertex by the transverse sutures but in most other respects *Palmapenna* resembles other members of the Ciriacremini and the genus is provisionally placed in this tribe.

Palmapenna hymenostegioides sp. n.

(Text-figs 1, 29, 59, 89, 93–95, 183, 184)

Description. *Colouration.* Overall body colour brown with ochraceous and orange mottling. Head ochraceous above, brown below; antenna with scape and pedicel brown, segments three to nine ochraceous with darkened tips, segment ten brown; dorsum of thorax with broad longitudinal ochraceous band, mesoscutellum brown antero-medially, pro- and mesopleurae brown, metapleurites ochraceous-green; fore wing hyaline with heavy brown pattern in distal third and in posterior half giving wing a paddle-like appearance (Text-fig. 59), veins alternately ochraceous and brown; fore leg brown with ochraceous mottling, middle and hind legs ochraceous with orange mottling; abdomen dark brown above, mottled ochraceous-orange ventrally.

Structure. ♂. Head about one and a half times longer than wide, sparsely haired dorsally, densely haired ventrally; post-orbital ridges absent, anteoccipital lobes reduced to small tubercles; genal cones well developed (Text-fig. 29), conical; antenna moderately long, flagellum 2·08–2·28 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·3 : 1·4 : 1·7 : 2·2 : 2·4 : 1·6 : 0·8; ultimate rostral segment 0·85–0·96 times as long as third antennal segment. Pronotum short, narrower than maximum width of head; propleural suture diagonal, episternum narrow above (Text-fig. 1), epimeron narrow below; fore wing venation and spinule arrangement as in Text-fig. 59; hind tibia with four or five spurs apically not arranged to form a ventral group. Proctiger (Text-fig. 93) with very short and narrow apical part, basal part broad with a pair of backwardly directed lateral expansions; paramere (Text-figs 93, 94) elongate conical, slightly longer than proctiger, inner surface evenly and densely covered with short curved setae and with a short thick spine postero-medially; subgenital plate (Text-fig. 93) without hypovalves.

♀. Antennal flagellum 2·10–2·43 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·4 : 1·3 : 1·6 : 2·1 : 2·3 : 1·5 : 0·7; ultimate rostral segment 0·81–0·93 times as long as third antennal segment. Ovipositor (Text-fig. 183) short, proctiger 0·69–0·75 times as long as hind tibia.

Measurements (±0·01 mm, based on 5 ♂ and 7 ♀). Maximum width of head, ♂ 0·64–0·72, ♀ 0·63–0·78; length of ultimate rostral segment, ♂ 0·11, ♀ 0·11–0·13; length of antennal flagellum, ♂ 1·46–1·51, ♀ 1·46–1·71; length of fore wing, ♂ 2·00–2·22, ♀ 2·16–2·50; length of hind tibia, ♂ 0·69–0·80, ♀ 0·71–0·85; length of ♀ proctiger, 0·52–0·61.

HOST PLANT. *Hymenostegia laxiflora* (Bentham) Harms. A long series of adults was collected from a group of young seedlings of the host plant in an old coffee forest that was reverting to its natural state.

Holotype ♂, ANGOLA: Salazar, I.I.A.A., 9–15.iii.1972, beaten from *Hymenostegia laxiflora* (*BM Southern Africa Expedition*) (BMNH, London), dry mounted.

Paratypes. ANGOLA: 125 ♂, 154 ♀, same data as holotype; dry and slide mounted, in 80% ethanol; deposited in BMNH, London; MNHU, Berlin; MRAC, Tervuren; USNM, Washington; ZI, Leningrad.

KLEINIELLA Aulmann, 1912

Kleiniella Aulmann, 1912*b* : 100. Type-species: *Kleiniella superba* Aulmann, by monotypy.

Desmiostigma Enderlein, 1927 : 240. Type-species: *Desmiostigma jassina* Enderlein, by monotypy. **Syn. n.**

Syndesmophlebia Vondracek, 1963 : 272. Type-species: *Syndesmophlebia oblongata* Vondracek, by monotypy. **Syn. n.**

DESCRIPTION. Large to medium size, head width 0·79–1·46 mm. Integument matt with a sparse covering of long hairs. Head as wide as or wider than pronotum and slightly depressed from axis of body; each lateral half of vertex with a median concavity; genal cones poorly or well developed, distinctly separated from vertex by transverse sutures; anteoccipital lobes present; antenna filiform, 2·0–4·5 times longer than width of head, flagellar segments bearing long hairs; ultimate rostral segment short, 0·25–0·89 times as long as third antennal segment and 1·2–1·8 times longer than tenth antennal segment. Thorax, in profile, convex; propleurites usually subequal and both in contact with pronotum dorsally. Fore wing parallelogrammatic or ellipsoid, normally hyaline with a clearly developed brown pattern, rarely uniformly brown; pterostigma sessile or pedunculate; veins bearing long hairs on dorsal surface, at least in proximal half of wing; costal and anal breaks present; *Rs* in punctiform contact with M_{1+2} or there is a short *rm* crossvein; costal setae of hind wing tending not to be arranged into groups. Fore femur with a few longer setae antero-ventrally, fore tibia with four to six pairs of longer setae dorsally; hind tibia with apical spurs usually arranged evenly around apex, rarely grouped to form a ventral comb. Male subgenital plate without hypovalves; proctiger with broad basal part and short, narrow apical part. Female ovipositor conical, proctiger 0·81–1·80 times longer than hind tibia.

Host plants. Unknown.

Distribution. Congo basin and montane forest regions of tropical Africa from Tanzania to Sierra Leone (Map 2).

Discussion. It is suggested here that the genus *Kleiniella* contains the following six species: *K. superba* Aulmann, *Desmiostigma jassina* Enderlein, *K. congoensis* sp. n., *Phacosema guineensis* Aulmann, *Syndesmophlebia oblongata* Vondracek and *K. medleri* sp. n.

According to Enderlein (1927) *D. jassina* differs from *K. superba* because of its smaller genal cones, the absence of hairs on the veins of the fore wing and the overall shape of the fore wing. In fact the wing veins in *jassina* do bear a double row of hairs on the dorsal surface and, in the proximal half of the wing, these hairs are long and similar to those found in *superba*. The wing shape in *jassina* is more like the parallelogrammatic wing of *superba* than the ellipsoid wing of *S. oblongata* and *K. medleri*. On this basis *Desmiostigma* is synonymized with *Kleiniella*.

K. guineensis (Aulmann), originally placed in the genus *Phacosema* but more naturally placed here, has an intermediate pterostigma condition for the genus. In *oblongata* and *medleri* the pterostigma is triangular and pedunculate, in *guineensis* it is triangular and sessile, and in *superba*, *jassina* and *congoensis* it is trapezoid and sessile.

The synonymy of *Syndesmophlebia* with *Kleiniella* is more difficult to accept. Together with *medleri*, *oblongata* is rather intermediate between *Kleiniella* and *Ciriacremum*. The wing veins, antennal segments, body and legs bear long hairs, the *rm* crossvein is punctiform or short, and the male subgenital plate lacks hypovalves, as in *Kleiniella*. On the other hand the pterostigma is pedunculate, the fore wing is ellipsoid and, in *medleri*, the apical spurs of the hind tibia are arranged to form a distinct ventral group, features these two species have in common with *Ciriacremum* species.

The states of expression and functional significance of these characters are not at all clear. However, in Text-fig. 20, using nine characters, a highly speculative phylogeny displaying the relationships among *Kleiniella* species and between *Kleiniella* and *Ciriacremum* is given. The nine characters used and their states of expression are as follows.

1. Wing pattern: absent – plesiomorphic, present – apomorphic; Text-figs 58, 60.
2. Wing vein setae: short – plesiomorphic, long – apomorphic; Text-figs 57, 61.
3. Antennal setae: short – plesiomorphic, long – apomorphic; Text-figs 5, 6.
4. Pterostigma: pedunculate – plesiomorphic, sessile – apomorphic; Text-figs 52, 62.

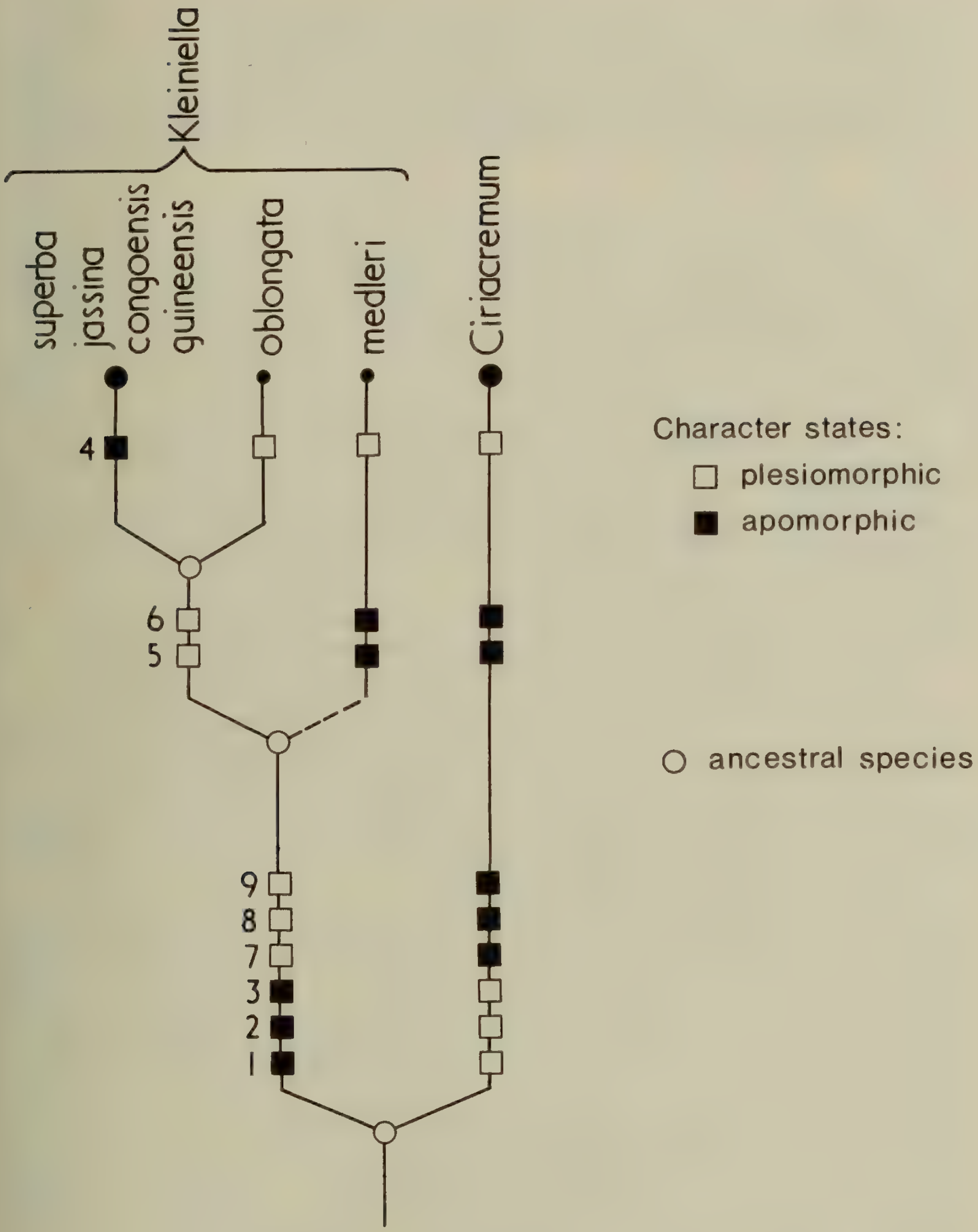

Kleiniella
superba
jassina
congoensis
guineensis
oblongata
medleri
Ciriacremum
4
6
5
9
8
7
3
2
1
Character states:
□ plesiomorphic
■ apomorphic
○ ancestral species

FIG. 20. Dendrogram of projected phylogeny within the Ciriacremini (for further explanation see text, p. 16).

5. Costal setae of hind wing: ungrouped – plesiomorphic, grouped – apomorphic; Text-figs 84, 90.
6. Hind tibial spurs: ungrouped ventrally – plesiomorphic, grouped ventrally – apomorphic; Text-figs 13, 14.
7. Body and leg setae: long – plesiomorphic, short – apomorphic; Text-figs 11, 12.
8. *rm* crossvein: punctiform – plesiomorphic, long – apomorphic; Text figs 58, 60.
9. Male hypovalves: absent – plesiomorphic, present – apomorphic; Text figs 96, 138.

It is postulated that the primitive Ciriacremini stock had all nine characters in the plesiomorphic condition. In the present day fauna where the characters are expressed in the apomorphic condition they are regarded as having been uniquely derived, although there are exceptions, e.g. *C. funestum* sp. n. has long hairs on the veins of the fore wing and a sessile pterostigma (see discussion of this species on p. 37).

KEY TO SPECIES OF *KLEINIELLA*

1 Genal cones poorly developed, only represented by weakly swollen areas of genae (Text-fig. 31) 2
– Genal cones well developed, rounded or obtusely conical (Text-figs 30, 32, 33). . 4
2 Pterostigma broadly sessile, trapezoidal (Text-fig. 52); male subgenital plate without hypovalves (Text-figs 96, 99) 3
– Pterostigma narrowly sessile, triangular (Text-fig. 82); male subgenital plate with well developed hypovalves (Text-fig. 129) ***Ciriacremum funestum*** sp. n. (p. 37)
3 Larger species, head width 0.96–1.12 mm; fore wing narrower, 2.40–2.72 times longer than wide, without spinules in costal cell or in proximal part of second radial cell (Text-fig. 52); apex of aedeagus as in Text-fig. 98; ♀ proctiger longer than hind tibia with downcurved apex (Text-fig. 187) . . . ***jassina*** (Enderlein) (p. 19)
– Smaller species, head with 0·85–0·93 mm; fore wing broader, 1·9–2·2 times longer than wide, spinules clearly present in costal cell and in proximal part of second radial cell (Text-fig. 53); apex of aedeagus as in Text-fig. 101; ♀ proctiger shorter than hind tibia, apical part not downcurved (Text-fig. 188) ***congoensis*** sp. n. (p. 20)
4 Pterostigma of fore wing pedunculate (Text-figs 57, 58) 5
– Pterostigma of fore wing sessile (Text-figs 51, 54–56) 6
5 Pterostigma short, about two and a half times longer than wide (Text-fig. 57); genal cones rounded rectangular (Text-fig. 32) . . ***oblongata*** (Vondracek) (p. 22)
– Pterostigma elongate, about eleven times longer than wide (Text-fig. 58); genal cones obtusely conical (Text-fig. 33) . . . . . ***medleri*** sp. n. (p. 23)
6 Pterostigma of fore wing broadly trapezoidal (Text-fig. 51) ***superba*** Aulmann (p. 18)
– Pterostigma of fore wing triangular or very narrowly trapezoidal (Text-figs 54–56) ***guineensis*** (Aulmann) (p. 21)

Kleiniella superba Aulmann, 1912

(Text figs 13, 51, 83, 185)

Kleiniella superba Aulmann, 1912*b* : 101, figs 1–4. LECTOTYPE ♀, TANZANIA: 'D. O. Afrika, Mkulumuri b. Amani, xii. 05, Dr Schröders. G' (MNHU, Berlin), here designated [examined].
Kleiniella superba Aulmann; Aulmann, 1913 : 79.

DESCRIPTION. *Colouration.* Overall body colour olive-green; fore wing pattern as in Aulmann's original figure.

Structure. ♂ unknown.

♀. Head as wide as pronotum; genal cones well developed, obtusely conical. Fore wing (Text-fig. 51 and original figure) parallelogrammatic, pterostigma broadly trapezoidal; *Rs* and M_{1+2} in punctiform contact, first cubital cell elongate; costal setae of hind wing forming a continuous row (Text-fig. 83); apex of hind tibia with three inner and two outer spurs. Ovipositor conical (Text-fig. 185), proctiger relatively short, 1·30 times longer than hind tibia.

Measurements (±0·01 mm, based on single incomplete ♀). Maximum width of head, ♀ 1·18; length of ultimate rostral segment, ♀ 0·13; length of hind tibia, ♀ 0·99; length of ♀ proctiger, 1·29.

HOST PLANT. Unknown.

MATERIAL EXAMINED.

Lectotype and one paralectotype ♀, same data and depository as lectotype.

DISCUSSION. Aulmann's type-series of two females are the only specimens of this species available for study and both are in a poor state of preservation. A permanent preparation has been made of the remnants of the lectotype. The antennae are missing (they were not mentioned in the original description) and only part of one fore wing remains (Text-fig. 51). However, from this remnant material and Aulmann's original description it is clear that *superba* is distinct from other species in the genus, having the most derived form of fore wing shape and venation.

Kleiniella jassina (Enderlein, 1927) **comb. n.**

(Text-figs 3, 5, 11, 31, 52, 86, 96–98, 187)

Desmiostigma jassina Enderlein, 1927 : 241, fig. 1. Holotype ♀, CAMEROUN: 'Kamerun' (IPK, Eberswalde) [unavailable for study].

DESCRIPTION. *Colouration.* Overall body colour light green with orange-brown markings. Lateral ocelli orange; thoracic tergites brown medially, mesopleurites brown; legs green with brown tarsal segments; fore wing pattern as in Text-fig. 52; abdomen orange-brown dorsally and ventrally.

Structure. ♂. Head wider than pronotum; genal cones very poorly developed (Text-fig. 31); antennal flagellum 2·09–2·21 times longer than maximum width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·1 : 1·5 : 1·9 : 1·9 : 1·1 : 0·5; ultimate rostral segment 0·74–0·81 times as long as third antennal segment. Fore wing parallelogrammatic, 2·40–2·52 times longer than wide, spinule arrangement as in Text-fig. 52; pterostigma broadly trapezoidal, dorsal surface of veins with a double row of long hairs in proximal half of wing, in distal half the hairs are shorter; *Rs* makes punctiform contact with M_{1+2} or there is a very short *rm* crossvein; *Cu* stem about two and a half times longer than $M+Cu$ stem; first cubital cell elongate, about twice as long as wide; apex of hind tibia with a pair of spurs on each side and a single ventral spur. Proctiger (Text-fig. 96) with oval lateral expansions in basal part and a short narrow apical part; paramere (Text-figs 96, 97) thumb-like, on inner surface with a large group of downwardly directed setae in apical part and a small median ridge in basal part; distal segment of aedeagus as in Text-fig. 98.

♀. Antennal flagellum 2·07–2·09 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·4 : 1·9 : 1·9 : 1·0 : 0·5; ultimate rostral segment 0·82 times as long as third antennal segment. Fore wing 2·49–2·65 times longer than wide. Ovipositor elongate conical (Text-fig. 187), proctiger 1·16–1·29 times longer than hind tibia, with downcurved apex.

Measurements (±0·01 mm, based on 6 ♂ and 3 ♀). Maximum width of head, ♂ 0·96–1·12, ♀ 1·02–1·12; length of antennal flagellum, ♂ 2·06–2·30, ♀ 2·13–2·26; length of ultimate rostral segment, ♂ 0·17–0·18, ♀ 0·18–0·19; length of fore wing, ♂ 3·00–3·63, ♀ 3·63–4·07; maximum width of fore wing, ♂ 1·25–1·46, ♀ 1·37–1·63; length of hind tibia, ♂ 1·08–1·23, ♀ 1·14–1·36; length of ♀ proctiger, 1·48–1·60.

HOST PLANT. Unknown.

MATERIAL EXAMINED.

ZAIRE: 1 ♂, Stanleyville, iv. 1928 (*A. Collart*); 3 ♂, 3 ♀, Yangambi, 0·47N–24·24E, x. 1956 (*N. L. H. Krauss*); 1 ♀, Elizabethville, xi. 1959, at light (*Ch. Seydel*). ANGOLA: 3 ♂, 1 ♀, Dundo, 4–29.viii.1953, light trap (*Luna*).

DISCUSSION. *K. jassina* is closely related to the following species and the two are regarded here as sister species. As both species have long setae on the antennal flagellum and the veins of the fore wing, a parallelogrammatic fore wing and a broadly trapezoid pterostigma, they are regarded here as more closely related to *K. superba* than the other three species of *Kleiniella*. *K. jassina* and *K. congoensis* clearly differ from *K. superba* in having poorly developed genal cones.

A number of cecidomyid fly larvae, probably of the genus *Endopsylla* (identified by K. M. Harris of the Commonwealth Institute of Entomology, London) were obtained from the abdomens of the series of specimens from Yangambi, Zaire.

***Kleiniella congoensis* sp. n.**

(Text-figs 53, 87, 99–101, 188)

DESCRIPTION. *Colouration.* Similar to *jassina* but with darker orange markings; fore wing pattern as in Text-fig. 53.

Structure. ♂. Similar to *jassina* but smaller. Antenna missing from holotype; ultimate rostral segment short. Fore wing broader than in *jassina*, 1·97 times longer than wide, with a moderately dense covering of spinules (Text-fig. 53), costal cell and proximal part of second radial cell with spinules; *Cu* stem about twice as long as *M+Cu* stem, first cubital cell shorter than in *jassina*, only one and a half times longer than wide. Genitalia similar to *jassina*; paramere (Text-figs 99, 100) thumb-like, on inner surface with short conical setae in apical two-thirds, without tubercle or ridges; distal segment of aedeagus relatively simple (Text-fig. 101).

♀. Slightly larger than ♂. Antennal flagellum 2·03 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·3 : 1·9 : 2·0 : 1·3 : 0·6; ultimate rostral segment 0·89 times as long as third antennal segment and 1·45 times longer than tenth antennal segment. Fore wing 2·11 times longer than wide. Ovipositor short (Text-fig. 188), proctiger with straight apex, 0·81 times as long as hind tibia.

Measurements (±0·01 mm, based on 1 ♂ and 1 ♀). Maximum width of head, ♂ 0·85, ♀ 0·93; length of antennal flagellum, ♀ 1·88; length of ultimate rostral segment, ♂ 0·15, ♀ 0·16; length of fore wing, ♂ 2·76, ♀ 3·11; maximum width of fore wing, ♂ 1·40, ♀ 1·48; length of hind tibia, ♂ 0·97, ♀ 1·03; length of ♀ proctiger, 0·84.

HOST PLANT. Unknown.

Holotype ♂, ZAIRE: Yangambi, 0·47N–24·24E, x. 1956 (*N. L. H. Krauss*) (BMNH, London); slide mounted.

Paratypes. ZAIRE: ♀, same data as holotype. NIGERIA: 1 ♀, SE. State, Oban, 7.iv.1975 (*J. T. Medler*) (BMNH, London), slide and dry mounted.

DISCUSSION. Obviously *K. congoensis* sp. n. is closely related to *K. jassina* but shows significant differences in the structure of the fore wing and genitalia of both sexes. The type-series was apparently collected together with specimens of *jassina*. Unfortunately no indication of host plant data was given by the collector and host preference may be the isolating factor between the two species.

Kleiniella guineensis (Aulmann, 1912) **comb. n.**

(Text-figs 30, 54, 85, 102–104)

Phacosema guineensis Aulmann, 1912*a* : 35, figs 1–6. Holotype ♂, EQUATORIAL GUINEA: 'Span. Guinea, Nkolentangan, xi. 07–v. 08, G. Tessmann S.G.' (MNHU, Berlin) [examined].
Udamostigma guineensis (Aulmann) Aulmann, 1913 : 81.

DESCRIPTION. *Colouration.* Overall body colour brown with ochraceous markings; vertex brown medially, ochraceous laterally; genal cones brown; dorsum of thorax brown, pronotum ochraceous laterally, mesoscutum with poorly developed longitudinal ochraceous markings, meso- and metascutellum brown medially and ochraceous laterally, propleurites ochraceous, mesopleurites brown; fore wing hyaline with brown pattern as in Text-fig. 54; legs mainly ochraceous, apex of fore femur, dorsally, and fore tarsal segments brown, mid femur and tarsus brown, hind femur, basally, and hind tarsus brown; abdomen brown dorsally, ochraceous ventrally.

Structure. ♂. Head wider than pronotum; genal cones well developed (Text-fig. 30), obtusely conical. Fore wing ellipsoid, 2·45 times longer than wide, spinule arrangement as in Text-fig. 54; pterostigma triangular; *Cu* stem slightly more than one and a half times longer than *M*+*Cu* stem, first cubital cell twice as long as wide. Apex of hind tibia with a pair of spurs on each side and a single ventral spur. Proctiger (Text-fig. 102) with oval lateral expansions in basal part and a short narrow apical part; paramere (Text-figs 102, 103) thumb-like, on inner surface with a few downwardly directed setae in apical part and a subapical tooth; distal segment of aedeagus as in Text-fig. 104.

♀. Unknown.

Measurements (±0·01 mm, based on 1 ♂). Maximum width of head, ♂ 0·79; length of ultimate rostral segment, ♂ 0·12; length of fore wing, ♂ 3·21; maximum width of fore wing, ♂ 1·31; length of hind tibia, ♂ 0·81.

MATERIAL EXAMINED.

Holotype and one further ♂ specimen from 'Westafrika, Uelleburg, vi–viii. 08' *Tessmann S. G.*) (MNHU, Berlin).

DISCUSSION. *K. guineensis* differs from both *K. superba* and *K. jassina* in having an ellipsoid fore wing and a triangular pterostigma. The sessile form of the latter also separates *guineensis* from *K. oblongata* and *K. medleri*.

Apart from the material mentioned above two female specimens have been examined which show slight but obvious differences from the type-series. As I have no clear idea of the extent to which *K. guineensis* varies I cannot assign these specimens to that or any other named species. A brief indication of their main characteristics is given below.

Kleiniella sp. 1, near *guineensis*

(Text-fig. 55)

♀. Similar to *guineensis*. Antennal flagellum 2·43 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·4 : 1·8 : 1·8 : 1·0 : 0·5; ultimate rostral segment short, 0·57 times as long as third antennal segment. Fore wing (Text-fig. 55) 2·28 times longer than wide, with less well developed pattern than *guineensis* and broader pterostigma; Cu stem two and a half times as long as $M+Cu$ stem, Cu_1 more steeply parabolic and first cubital cell slightly less than twice as long as wide. Proctiger relatively long, 1·77 times longer than hind tibia. ♂ unknown. Host plant unknown.

Measurements (±0·01 mm, based on 1 ♀). Maximum width of head, ♀ 0·86; length of antennal flagellum, ♀ 2·09; length of ultimate rostral segment, ♀ 0·12; length of fore wing, ♀ 3·15; maximum width of fore wing, ♀ 1·38; length of hind tibia, ♀ 0·74; length of ♀ proctiger, 1·31.

MATERIAL EXAMINED.

NIGERIA: 1 ♀, SE. State, Obudu CR, 21.iii.1971 (*J. T. Medler*) (BMNH, London).

Kleiniella sp. 2, near *guineensis*

(Text-fig. 56)

♀. Similar to *guineensis* and preceding species. Genal cones rather more robust (Text-fig. 56); antennal flagellum 2·43 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·0 : 1·2 : 1·6 : 1·5 ; 0·8 : 0·3; ultimate rostral segment shorter, 0·45 times as long as third antennal segment. Fore wing slightly more parallelogrammatic (Text-fig. 56), 2·55 times longer than wide, pterostigma broadly triangular, Cu stem almost three times longer than $M+Cu$ stem, first cubital cell about twice as long as wide. Proctiger shorter, 1·48 times longer than hind tibia. ♂ unknown. Host plant unknown.

Measurements (±0·01 mm, based on 1 ♀). Maximum width of head, ♀ 1·02; length of antennal flagellum, ♀ 2·48; length of ultimate rostral segment, ♀ 0·13; length of fore wing, ♀ 3·83; maximum width of fore wing, ♀ 1·38; length of hind tibia, ♀ 1·00; length of ♀ proctiger, 1·48.

MATERIAL EXAMINED.

UGANDA: 1 ♀, Ruwenzori Range, Bwamba Pass (west side), xii. 1934–i. 1935, 5500′–7500′ [1680–2290 m] (*F. W. Edwards*) (BMNH, London).

Kleiniella oblongata (Vondracek, 1963) **comb. n.**

(Text-figs 32, 57, 84, 105–107)

Syndesmophlebia oblongata Vondracek, 1963 : 273, figs 31–45. Holotype ♂, ZAIRE: 'Rutshuru, 27.v.1936 (L. Lippens)' (MRAC, Tervuren) [examined].

DESCRIPTION (for more details see original description). ♂. Head wider than pronotum; genal cones well developed, rounded rectangular from above (Text-fig. 32); ultimate rostral segment short. Fore wing ellipsoid, 2·54 times longer than wide, spinule arrangement as in Text-fig. 57; pterostigma pedunculate, short; Rs and M_{1+2} in punctiform contact; first cubital cell elongate, more than twice as long as wide; Cu stem about three times longer than $M+Cu$ stem; costal setae of hind wing forming a continuous row (Text-fig. 84); apex of hind tibia with three inner and two outer spurs. Proctiger (Text-fig. 105) with oval lateral expansions in basal part and a short narrow apical part; paramere (Text-fig. 106) thumb-like, on inner surface with a subapical tooth and a number of downwardly directed setae in apical half, in basal half with a group of anteriorly directed setae; distal segment of aedeagus as in Text-fig. 107.

♀. Antennal flagellum 2·30 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·3 : 1·8 : 1·8 : 0·6 : 0·3; ultimate rostral segment 0·58 times as long as third antennal segment. Fore wing 2·57 times longer than wide. Proctiger relatively long, 1·80 times longer than hind tibia.

Measurements (±0·01 mm, based on 1 ♂ and 1 ♀). Maximum width of head, ♂ 1·36, ♀ 1·46; length of antennal flagellum, ♀ 3·37; length of ultimate rostral segment, ♂ 0·20, ♀ 0·21; length of fore wing, ♂ 5·10, ♀ 5·70; maximum width of fore wing, ♂ 2·00, ♀ 2·22; length of hind tibia, ♂ 1·13, ♀ 1·24; length of ♀ proctiger, 2·22.

HOST PLANT. Unknown.

MATERIAL EXAMINED.

Holotype and 1 ♀ paratype from ZAIRE: Luebo, viii. 1921 (*Lt. Ghesquière*) (MRAC, Tervuren). Both specimens had been dissected and mounted on several slides; some remounts were necessary.

DISCUSSION. Unlike the three previous species *K. oblongata* has a pedunculate pterostigma and an ellipsoid fore wing, features it has in common with *K. medleri* sp. n. and most species of *Ciriacremum*. It differs from *medleri* in the shape of the genal cones, the short pterostigma and the form of the male genitalia. It is placed in *Kleiniella* because of the long hairs on the veins of the fore wing, antennal flagellum and fore tibia, the absence of a ventral group of spurs at the apex of the hind tibia and the absence of hypovalves on the male subgenital plate.

***Kleiniella medleri* sp. n.**

(Text-figs 33, 58, 88, 108–110, 186)

DESCRIPTION. *Colouration.* Overall body colour mid brown with light green or ochraceous markings; vertex green with central brown area and orange ocelli; genal cones green with reddish brown apices; antenna ochraceous with darkened area at joints of segments, segments nine and ten brown; pronotum brown anteriorly, green posteriorly and laterally; propleurites green; mesopraescutum brown with green lateral and hind margins and median longitudinal ochraceous stripe; mesoscutum brown with median greenish area, with a proximo-lateral ochraceous stripe and a disto-lateral green patch on each side; mesoscutellum brown with green antero-lateral areas; metascutellum green; parapteron brown dorsally, ochraceous-green ventrally; fore wing pattern as in Text-fig. 58; legs brown, hind tibia ochraceous; abdomen reddish brown dorsally, green dorso-laterally, dark brown ventro-laterally and yellow ventrally; ♂ proctiger with reddish apical part.

Structure. ♂. Head wider than pronotum; genal cones well developed, conical with rounded apices (Text-fig. 33); antennal flagellum relatively long, 4·23–4·48 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·4 : 1·4 : 1·8 : 0·5 : 0·2; ultimate rostral segment relatively short, 0·28–0·31 times as long as third antennal segment. Fore wing ellipsoid (Text-fig. 58), 2·36–2·48 times longer than wide; pterostigma pedunculate and very long, continuing almost to point where *Rs* meets costa; *Cu* stem almost twice as long as *M*+*Cu* stem; Cu_1 steeply parabolic and first cubital cell about 1·3 times longer than wide; costal setae of hind wing arranged into two groups (Text-fig. 88); apex of hind tibia with one inner and one outer spur and a ventral group of two or three spurs. Proctiger (Text-fig. 108) with triangular wing-like expansions on basal part and a short narrow apical part; paramere

(Text-figs 108, 109) thumb-like, on inner surface with a postero-apical ridge which ends in an apical tooth, apical part with a vertical row of five antero-ventrally directed setae, basal part with a large group of posteriorly directed setae; distal segment of aedeagus as in Text-fig. 110.

♀. Larger than ♂. Antennal flagellum 4·37–4·43 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·3 : 1·4 : 1·8 : 0·5 : 0·2; ultimate rostral segment 0·25–0·30 times as long as third antennal segment. Fore wing 2·36–2·43 times longer than wide. Proctiger moderately long (Text-fig. 186), 1·49–1·60 times longer than hind tibia.

Measurements (±0·01 mm, based on 7 ♂ and 6 ♀). Maximum width of head, ♂ 1·01–1·19, ♀ 1·03–1·26; length of antennal flagellum, ♂ 4·41–5·28, ♀ 4·55–5·58; length of ultimate rostral segment, ♂ 0·15–0·18; ♀ 0·16–0·18; length of fore wing, ♂ 2·92–3·42, ♀ 3·12–3·69; maximum width of fore wing, ♂ 1·18–1·40 ♀ 1·32–1·52; length of hind tibia, ♂ 0·78–0·95, ♀ 0·81–1·00; length of ♀ proctiger, 1·23–1·49.

HOST PLANT. Unknown.

Holotype ♂, NIGERIA: W. State, Ile–Ife, 25.iii.1969 (*J. T. Medler*) (BMNH, London). Dry mounted.

Paratypes. NIGERIA: 2 ♂, 4 ♀, same data as holotype; 1 ♂, 28.ii.1970; 1 ♂, 19.iii.1970; 1 ♀, 30.vi. 1970; 2 ♂, 29.xii.1970; 4 ♂, 26.ii.1971; 1 ♂, 9.i.1973; 1 ♂, 1 ♀, Akure, x. 1974; 1 ♀ NW. State, Badeggi RRS, 19.iii.1972; 2 ♂, 14.xii.1974; 1 ♂, Abuja, 20.iii.1972; 1 ♂, 1 ♀, MW. State, Benin, 8.iv.1973; 4 ♂, 3 ♀, 1.iv.1975; 1 ♀, nr Siluko, iii. 1973; 3 ♂, 3 ♀, Udo FR, 11.iv.1975; 1 ♂, 1 ♀, W. State, Agbabu, 3.iii.1973; 1 ♂, BP. State, Takuni, 19.iii.1973; 1 ♂, 1 ♀, SE. State, Ikom, 4.iv.1975; 2 ♂, 1 ♀, Ibadan, 15.iii.1969 (*J. T. Medler*); 8 ♂, 3 ♀, Ibadan, Moor Plantation, 23. ix.–2.x.1960, light trap (*L. A. Mound*); 1 ♂, 1 ♀, Zaria, Samaru, 11.ix.1974, to light (*J. C. Deeming*). GHANA: 2 ♂, 2 ♀, Tafo, Cocoa Res. Inst., 1973, light trap (*N. A. K. Akotoye*). SIERRA LEONE: 1 ♀, Njala, 15.xi.–8.xii.1930, at light (*E. Hargreaves*). (BMNH, London; ZI, Leningrad; NCI, Pretoria). Slide and dry mounted.

DISCUSSION. It is difficult to assign this species to a genus as it has features in common with both *Kleiniella* and *Ciriacremum* species. *K. medleri* sp. n. has long setae on the antennal flagellum, wing veins and legs, a short *rm* crossvein, and lacks hypovalves in the male, as in *Kleiniella*; but has a pedunculate pterostigma, a ventral group of spurs at the apex of the hind tibia, and grouped costal setae on the hind wing, as in *Ciriacremum*. On the basis that *medleri* sp. n. shares more derived features with *Kleiniella* species than *Ciriacremum* species it is arbitrarily placed in the former genus.

CIRIACREMUM Enderlein, 1910

Ciriacremum Enderlein, 1910*b* : 139. Type-species: *Ciriacremum filiverpatum* Enderlein, by original designation.

Ciriacremum Enderlein; Aulmann, 1913 : 80.

Ceriacremum Enderlein; Crawford, 1914 : 63, partim. [Incorrect subsequent spelling.]

Bunoparia Enderlein, 1926 : 397. Type-species: *Ciriacremum capillicorne* Enderlein, by original designation. **Syn. n.**

DESCRIPTION. Small to large size, head width 0·52–1·37 mm. Integument matt, with a moderate covering of short hairs. Head wider than pronotum and depressed from axis of body; each lateral half of vertex with a median concavity; genae from slightly swollen to having well developed cones, distinctly separated from vertex by transverse sutures; anteoccipital lobes present; antenna filiform, short or long, flagellum 1·2 to more than 5·5 times longer than width of head, flagellar segments bearing short hairs; ultimate rostral segment short or long. Thorax, in profile, convex; propleurites subequal and both in contact with pronotum dorsally; fore wing ellipsoid, sometimes a little elongated, usually hyaline, rarely with a marginal infuscation distally, sometimes with small darkened areas in the marginal cells distally; pterostigma usually pedunculate, rarely sessile; veins usually bear short hairs on dorsal surface, rarely these hairs are longer than the width of veins; long *rm* crossvein present; costal setae of hind wing clearly arranged into two groups; fore tibia without long setae or with only a single seta dorsally; hind tibia with apical spurs arranged into lateral and ventral groups. Male subgenital plate mostly with a clearly developed pair of hypovalves, rarely fused to form a single structure, rarely without hypovalve development; proctiger usually with moderately narrow basal part and narrower apical part which is often as long as or longer than basal part. Female ovipositor conical, proctiger short or long, 1·0–2·7 times longer than hind tibia. Larva free-living psylloid type (Text-figs 24–27).

DISTRIBUTION. West, central, east and southern Africa, in both forest and woodland areas (Maps 3–7); Central America.

HOST PLANTS. Data are known for eight of the 23 known species in the genus and all the host plants are from the family Caesalpiniaceae.

DISCUSSION. From the phylogeny postulated above (p. 16) it can be seen that *Ciriacremum* species are separated from *Kleiniella* on the basis of common possession in the former of three derived features: short body and leg setae, a long *rm* crossvein, and the presence of hypovalves on the male subgenital plate. They also differ from most of the species in *Kleiniella*, *medleri* being the exception, in having grouped costal setae on the hind wing and apical spurs of the hind tibia forming a distinct ventral group; two further derived features. One of the most interesting of these attributes is the presence of hypovalves on the male subgenital plate. Development of these structures is very rare within the Psylloidea and I know of them occurring only in two other groups, *Mesohomotoma* and related genera, and an undescribed genus distributed in tropical Africa which may be a member of the Spondyliaspidae. The function of these structures is not known; they could be used by the male to orientate himself appropriately during copulation or to induce the required response in the female by tactile or visual stimulus. A study of these structures in relation to psyllid reproductive behaviour would be very interesting and informative. Three species in the genus, *filiverpatum capillicorne* and *capense*, lack these hypovalves and it is not clear whether this condition is primitive or the result of secondary loss.

By a comparative study of the male genitalia within the genus some species groups are easily defined but the relationships of a few species cannot be clearly shown so a phylogeny for *Ciriacremum* is not postulated. Some of the more obvious species groups are: *filiverpatum* with *pervatum*, *relatum* and *kleinielloides*; *bicaudatum* with *harteni*, *capeneri*, *carvalhoi*, *daubicatum*, *cabudiatum*, *tubacadium*, *jubernardioides* and *orientale*; and *africanum* with *megafricanum*, *vondraceki* and possibly *angolense*.

The type male of *C. capillicorne* could not be traced and no further material was available for study. As this species is the type-species of *Bunoparia* the synonymy given above must remain speculative. Enderlein separated *Bunoparia* from

Ciriacremum on the basis of the form of the genal cones. These structures are very variable interspecifically in the Ciriacremini and I do not think their form has any great significance when considering generic limits.

KEY TO SPECIES OF *CIRIACREMUM*

1 Pterostigma sessile (Text-figs 63, 82) 2

– Pterostigma pedunculate (Text-figs 64–81) 3

2 Larger elongate species, head width 1·13 mm, antennal flagellum 4·27 times longer than width of head; fore wing 2·69 times longer than wide **kleinielloides** sp. n. (p. 32)

– Smaller, more robust species, head width 0·78–0·93 mm; antennal flagellum 2·50–3·10 times longer than width of head; fore wing 2·3–2·5 times longer than wide **funestum** sp. n. (p. 37)

3 Hairs on dorsal surface of veins of fore wing more than twice as long as width of veins (Text-fig. 58); hairs on segments of antennal flagellum longer than width of pedicel (Text-fig. 5) **Kleiniella medleri** sp. n. (p. 23)

– Hairs on veins of fore wing short, not or hardly longer than width of veins (Text-fig. 60); hairs on antennal flagellum short, not longer than width of pedicel (Text-fig. 6) 4

4 Males 5

– Females 26

5 Subgenital plate without an extra pair of appendages (hypovalves) terminally (Text-figs 111, 132) 6

– Subgenital plate with a pair of hypovalves terminally (Text-figs 114, 126, 138) 9

6 Proctiger with wing-like expansions laterally (Text-fig. 132) 7

– Proctiger without wing-like expansions laterally (Text-fig. 111) **filiverpatum** Enderlein (p. 29)

7 Antenna very long, more than twice as long as length of body **capillicorne** Enderlein (p. 35)

– Antenna shorter, at most as long as body 8

8 Genal cones short, from above wider than long (Text-fig. 47); fore wing with few spinules (Text-fig. 81). Southern Africa **capense** Enderlein (p. 35)

– Genal cones longer than wide; fore wing evenly and densely covered in spinules. Central America **setosum** Crawford

9 Hypovalves fused to form a single structure (Text-figs 168, 170) **capeneri** sp. n. (p. 43)

– Hypovalves paired (Text-figs 114, 126, 138) 10

10 Hypovalves longer than or at least as long as parameres (Text-figs 129, 138) 11

– Hypovalves shorter than parameres (Text-figs 114, 123, 172) 19

11 Membrane of fore wing densely and evenly covered with spinules (Text-fig. 75) 12

– Membrane of fore wing at least with areas on either side of veins devoid of spinules (Text-figs 68, 78) 13

12 Antennal flagellum 1·6–2·2 times longer than maximum width of head **julbernardioides** sp. n. (p. 45)

– Antennal flagellum 1·2–1·5 times longer than maximum width of head **orientale** sp. n. (p. 46)

13 Antenna short, flagellum 1·9–2·3 times longer than width of head **harteni** sp. n. (p. 42)

– Antenna longer, flagellum 2·6–3·4 times longer than width of head 14

14 Genal cones poorly developed (Text-fig. 49); distal segment of aedeagus relatively short and robust with a long terminal tube (Text-fig. 180) **vondraceki** sp. n. (p. 51)

– Genal cones well developed (Text-figs 38–42); distal segment of aedeagus relatively long and thin, with a short terminal tube (Text-figs 141, 149) 15

15 Hypovalves with a small group of specialized setae subapically on dorsal surface (Text-fig. 161) ***carvalhoi*** sp. n. (p. 41)

– Hypovalves without a group of specialized setae subapically but often with such a group medially on dorsal surface (Text-figs 138, 143) 16

16 Third antennal segment 2·3–2·7 times longer than ultimate rostral segment; distal segment of aedeagus with broad apex (Text-fig. 149) ***cabudiatum*** sp. n. (p. 40)

– Third antennal segment less than 2·2 times longer than ultimate rostral segment; apex of distal segment of aedeagus narrower (Text-figs 141, 145) 17

17 Hypovalves very long and narrow, apical part no wider than apical part of proctiger, median group of specialized setae well developed (Text-fig. 143) ***daubicatum*** sp. n. (p. 40)

– Hypovalves broader, apical part almost twice as wide as apical part of proctiger, median group of specialized setae poorly developed (Text-figs 138, 139, 150) 18

18 Paramere with long and narrow apical part, on inner surface the postero-medial group of setae are restricted to an area immediately below the tooth (Text-fig. 140); hypovalves with inner postero-vertical row of setae relatively well developed (Text-fig. 16) ***bicaudatum*** Enderlein (p. 37)

– Paramere with a very short narrow apical part, on inner surface the postero-medial group of setae are curved and extended to form a compound vertically arranged group (Text-fig. 151); hypovalves with inner postero-vertical row of setae poorly developed (Text-fig. 150) ***tubacadium*** sp. n. (p. 44)

19 Antennal flagellum at most 2·5 times longer than maximum width of head 20

– Antennal flagellum at least 4·0 times longer than width of head 22

20 Paramere broad, shorter than proctiger, with a longitudinally arranged group of sensory pegs on inner surface (Text-fig. 176); antennal flagellum not more than 2·2 times longer than width of head; ultimate rostral segment longer than length of third antennal segment 21

– Paramere narrow, about as long as proctiger, without trace of specialized sensory pegs on inner surface (Text-fig. 136); antennal flagellum not less than 2·3 times longer than width of head; ultimate rostral segment much shorter than third antennal segment ***jilorense*** sp. n. (p. 52)

21 Ultimate rostral segment shorter, 1·00–1·45 times longer than third antennal segment ***africanum*** Enderlein (p. 48)

– Ultimate rostral segment longer, 1·50–1·75 times longer than third antennal segment ***megafricanum*** sp. n. (p. 49)

22 Postero-basal patch of sensory hairs on inner surface of paramere present (Text-figs 115, 118, 121, 127) 23

– Postero-basal patch of sensory hairs on inner surface of paramere absent (Text-figs 123, 124) ***nigeriense*** sp. n. (p. 33)

23 Genal cones represented by two rounded areas, often shiny brown or black (Text-fig. 34) 24

– Genal cones, although small, clearly present and not at all shiny (Text-figs 35, 37) 25

24 Ultimate rostral segment long, 2·29 times longer than tenth antennal segment; $M+Cu$ stem about two-thirds as long as Cu stem (Text-fig. 61); paramere as in Text-fig. 118 ***relatum*** sp. n. (p. 31)

– Ultimate rostral segment shorter, 1·48–1·88 times longer than tenth antennal segment; $M+Cu$ stem at most half as long as Cu stem (Text-fig. 62); paramere as in Text-fig. 115 ***pervatum*** sp. n. (p. 30)

25 Antennal flagellum shorter, 4·19 times longer than width of head; Cu_1 steeply parabolic, second radial cell devoid of spinules (Text-fig. 64) ***angolense*** sp. n. (p. 34)

– Antennal flagellum longer, 4·90–5·26 times longer than width of head; Cu_1 weakly parabolic, second radial cell with spinules at least in distal half (Text-fig. 65) ***nigripes*** sp. n. (p. 32)

26 Fore wing densely and evenly covered with spinules (Text-fig. 75) 27

– Fore wing at least with narrow bands on either side of veins devoid of spinules and often with other areas without spinules (Text-figs 78, 79) 29

27 Genal cones well developed, longer than wide. Central America ***setosum*** (Crawford)

– Genal cones moderately developed, wider than long. Ethiopian region . . 28

28 Antennal flagellum 1·7–2·3 times longer than width of head ***julbernardioides*** sp. n. (p. 45)

– Antennal flagellum 1·2–1·4 times longer than width of head ***orientale*** sp. n. (p. 46)

29 Antennal flagellum not more than 3·3 times longer than width of head . . 34

– Antennal flagellum not less than 3·9 times longer than width of head . . 30

30 Ultimate rostral segment relatively short (Text-fig 3), 1·1–1·6 times longer than tenth antennal segment; genal cones present but poorly developed (Text-figs 35, 36) 31

– Ultimate rostral segment relatively long (Text-fig. 4), 1·7–2·5 times longer than tenth antennal segment; genal areas only slightly swollen and often shiny brown or black 32

31 Ovipositor relatively short, proctiger 1·58–1·76 times longer than hind tibia, valves of ovipositor not modified (Text-fig. 188) . . . ***nigripes*** sp. n. (p. 32)

– Ovipositor relatively long, proctiger 2·22–2·49 times longer than hind tibia, valves of ovipositor elongated apically (Text-fig. 189) . . ***nigeriense*** sp. n. (p. 33)

32 Antennal flagellum very long, 5·5–6·2 times longer than width of head; larger species, hind tibia 1·0–1·1 mm long . . . . ***relatum*** sp. n. (p. 31)

– Antennal flagellum shorter, 3·9–5·3 times longer than head width; smaller species, hind tibia 0·70–0·90 mm long 33

33 Ultimate rostral segment shorter, 1·7–1·9 times longer than 10th antennal segment; proctiger longer, 2·4–2·7 times longer than hind tibia . ***pervatum*** sp. n. (p. 30)

– Ultimate rostral segment longer, 2·0–2·5 times longer than 10th antennal segment; proctiger shorter, 2·0–2·2 times longer than hind tibia ***filiverpatum*** Enderlein (p. 29)

34 Antennal flagellum 2·7–3·3 times longer than width of head; genal cones usually well developed (Text-figs 38–40) 35

– Antennal flagellum not more than 2·4 times longer than width of head; genal cones poorly developed (Text-fig. 48) 40

35 Proctiger less than 1·5 times longer than hind tibia 36

– Proctiger more than 1·5 times longer than hind tibia 38

36 Smaller species, head width about 0·71 mm; ultimate rostral segment relatively long, 0·58–0·62 times as long as third antennal segment; ovipositor shorter, less than 1·1 times longer than hind tibia . . . . ***vondraceki*** sp. n. (p. 51)

– Larger species, head width 0·78–0·94 mm; ultimate rostral segment relatively short, 0·39–0·52 times as long as third antennal segment; ovipositor longer, 1·28–1·41 times longer than hind tibia 37

37 Fore wing relatively narrow, 3·2–3·6 times longer than width of head, pterostigma small (Text-fig. 70) . . . . ***cabudiatum*** sp. n. (p. 40)

– Fore wing relatively broad, 2·8–3·1 times longer than width of head, pterostigma large (Text-fig 81) . . . . . . ***capense*** Enderlein (p. 35)

38 Third antennal segment not more than 2·0 times longer than ultimate rostral segment 39

– Third antennal segment not less than 2·1 times longer than ultimate rostral segment ***carvalhoi*** sp. n. (p. 41)

39 Proctiger 1·6–1·8 times longer than hind tibia . . . ***daubicatum*** sp. n. (p. 40)

– Proctiger more than 1·9 times longer than hind tibia ***bicaudatum*** Enderlein (p. 37) and ***tubacadium*** sp. n. (p. 44)

40 Ultimate rostral segment longer than third antennal segment 41

– Ultimate rostral segment shorter than third antennal segment 42

41 Proctiger relatively long, 1·7–1·9 times longer than hind tibia; ultimate rostral segment relatively long, 1·4–1·8 times longer than third antennal segment **megafricanum** sp. n. (p. 49)
– Proctiger relatively short, 1·3–1·5 times longer than hind tibia; ultimate rostral segment relatively short, 1·0–1·3 times longer than third antennal segment **africanum** Enderlein (p. 48)
42 Second radial cell of fore wing with no spinules proximally and only a few spinules in distal part (Text-fig. 80) . . . . . . **jilorense** sp. n. (p. 52)
– Second radial cell of fore wing more evenly spinuled throughout (Text-figs 72, 74) . 43
43 Fore wing narrow, 2·36–2·69 times longer than wide; proctiger longer, 1·5–1·7 times longer than hind tibia . . . . . . **capeneri** sp. n. (p. 43)
– Fore wing wider, 2·26–2·40 times longer than wide; proctiger shorter, 1·3–1·4 times longer than hind tibia . . . . **harteni** sp. n. (p. 42)

Ciriacremum filiverpatum Enderlein, 1910

(Text-figs 4, 34, 60, 90, 111–113, 190)

Ciriacremum filiverpatum Enderlein, 1910*b* : 139, text-fig. A, fig. 1. LECTOTYPE ♂, TANZANIA: 'Deutsches Ost Afrika' (NR, Stockholm), here designated [examined].
Ciriacremum filiverpatum Enderlein; Aulmann, 1912*b* : 101.
Ciriacremum filiverpatum Enderlein; Aulmann, 1913 : 80.

DESCRIPTION. *Colouration.* Overall body colour mid brown with ochraceous and black markings; vertex brown, ocelli orange, anteoccipital lobes ochraceous; genae ochraceous, each with a median shiny brown or black area; pronotum dark brown anteriorly and laterally, posterior margin ochraceous; mesopraescutum brown with ochraceous postero-lateral patches; mesoscutum brown, often with broad median longitudinal dark stripe and pale lateral patches; mesoscutellum brown with ochraceous antero-lateral corners; metascutellum ochraceous; tegula and pleurae light brown; wings hyaline; legs ochraceous with darkened tarsal segments; abdomen dark brown dorsally, ochraceous ventrally.

Structure. ♂. Anteoccipital lobes close to lateral ocellar humps; genae rounded, hardly swollen (Text-fig. 34); antenna long, flagellum 4·03–4·69 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·2 : 1·4 : 1·7 : 0·4 : 0·2; ultimate rostral segment long, 0·40–0·52 times as long as third antennal segment and 2·04–2·51 times longer than 10th antennal segment. Fore wing elongate, 2·71–2·84 times longer than wide; *Cu* stem slightly more than twice as long as $M+Cu$ stem; first cubital cell elongate, about two and a half times longer than wide; spinule arrangement as in Text-fig. 60. Proctiger (Text-fig. 111) with simple basal part and a moderately long and narrow apical part; paramere (Text-figs 111–112) laterally flattened, pentagonal, on inner surface with a small anterior subapical tooth, a large apical tooth and a postero-apical ridge, in basal part with a large group of posteriorly directed hairs; distal segment of aedeagus as in Text-fig. 113; subgenital plate without hypovalves (Text-fig. 111).

♀. Larger than ♂. Antennal flagellum 3·96–4·55 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·2 : 1·4 : 1·8 · 0·4 : 0·2; ultimate rostral segment 0·45–0·52 times as long as third antennal segment and 2·02–2·47 times longer than tenth antennal segment. Fore wing 2·77–2·89 times longer than wide. Ovipositor long (Text-fig. 190), proctiger 2·05–2·17 times longer than hind tibia.

Measurements (±0·01 mm, based on 10 ♂ and 6 ♀). Maximum width of head, ♂ 0·99–1·09, ♀ 1·01–1·12; length of antennal flagellum, ♂ 4·11–4·90, ♀ 4·32–4·67; length of ultimate rostral segment, ♂ 0·25–0·29, ♀ 0·27–0·29; length of fore wing, ♂ 3·00–3·43, ♀ 3·25–3·70; maximum width of fore wing, ♂ 1·06–1·23, ♀ 1·13–1·33; length of hind tibia, ♂ 0·78–0·89, ♀ 0·77–0·89; length of ♀ proctiger, 1·67–1·92.

HOST PLANT. Some adults have been collected from *Brachystegia spiciformis* Bentham in Rhodesia but the bulk of the material examined was collected at light.

Material examined.

Central African Republic: 2 ♂, 2 ♀, La Maboke, 7.xi.1966, at light (*M. Boulard*). Zaire: 1 ♀, Katanga, Elizabethville, ix. 1925; 11 ♂, 4 ♀, x. 1926; 7 ♂, 8 ♀, x. 1936; 12 ♂, 9 ♀, ix.–xii. 1949, at light; 1 ♂, x. 1954, at light; 1 ♂, 1 ♀ ix. 1958–v. 1959, at light; 8 ♂, 18 ♀, ix.–x. 1959, at light (*Ch. Seydel*); 1 ♂, 2 ♀, ii. 1940 (*H. Bredo*); 3 ♂, 2 ♀, ix. 1931 (*T. D. A. Cockerell*); 1 ♀ Kapema, ix. 1924 (*Ch. Seydel*); 2 ♀, Kanzenze, 12.viii.1931 (*G. F. de Witte*); 2 ♀, Kundelungu, riv. Kalumbulwa, 18.x.1951 (*G. Marlier*); 6 ♂, 5 ♀, Kolwezi, 5.x.1953, at light (*Mme L. Gilbert*); 1 ♂, 1 ♀, Bianco, 8–11.viii.1931 (*J. & L. Ogilvie*); 1 ♀, Sakania, ix. 1931 (*A. Mackie*); 3 ♂, 5 ♀, Kivu, Kavimvira (Uvira), ix.–x. 1954, at light (*G. Marlier*). Angola: 2 ♀, Gangassol, x. 1972, at light; 1 ♂, 10 ♀, Nova Lisboa, 23.ix.1968 (*M. Umbelina*); 4 ♂, 10 ♀, 19–27.viii.1974, at light; 82 ♂, 5 ♀, Chianga, 7–9.xi.1966, at light; 15 ♂, 25 ♀, 17.x.1972, at light; 39 ♂, 50 ♀, 26.viii.1974, at light (*J. Passos de Carvalho*); 1 ♂, 2 ♀, 5–19.ix.1970, yellow tray (*A. van Harten*); 1 ♀, 8.ix.1963, at light (*H. Cardosa*); 16 ♂, 16 ♀, Ceilunga, 8.x.1972, at light; 2 ♂, 2 ♀, Cela, 27.viii. 1973; 1 ♂, Salazar, I.I.A.A., 29.xi.1972, at light; 1 ♀, viii. 1973 (*J. Passos de Carvalho*); 4 ♂, 2 ♀, Dundo, 4–29.viii.1953, light trap (*Luna*); 2 ♀, Benguela, Baia Farta (12·36S, 13·12E), vi. 1963, at light (*Aldino Victorina*); 1 ♀, Luzamba (9·03S, 18·07E), 22.v.–2.vi.1971, at light (*S. A. Peles*); 1 ♀, Lac Calundo (11·48S, 20·52E), 1150 m, 19.xii.1954, at light (*Machado & Luna*). Tanzania: 3 ♂, 4 ♀, 'Deutsches Ost Afrika' (type-series). Rhodesia: 6 ♂, 8 ♀, Salisbury, 21.xi.1967, from *Brachystegia spiciformis* (*J. R. McDaniel*); 1 ♂, 2 ♀, Bulawayo, iv. 1968, at light (*B. M. Gerard*); 5 ♂, 7 ♀, Gokwe Distr., nr Kandariandzee Pan, viii.–ix. 1974, light trap (*G. F. Cockbill*).

Discussion. *C. filiverpatum*, together with the following three species, seem to form a natural group within the genus *Ciriacremum*. All these species have a peculiar head shape in which the genal areas are only slightly swollen and are mostly shiny brown or black. Apart from *C. kleinielloides*, which is only known from the female, they all have similar male genitalia; the paramere is of a similar form, showing slight variations in the form of the apical teeth and ridges (Text-figs 112, 115, 118); the distal segment of the aedeagus is very similar (Text-figs 113, 116, 119); and the subgenital plate shows a complete progression from having well developed hypovalves in *C. pervatum* sp. n. (Text-fig. 114), through partly reduced hypovalves in *C. relatum* sp. n. (Text-fig. 117) to their complete reduction in *C. filiverpatum*. In all four species the wing shape and venation is very similar.

Enderlein's type-series is stored in alcohol and permanent microscopical preparations have been made of the lectotype and male paralectotype.

***Ciriacremum pervatum* sp. n.**

(Text-figs 12, 62, 114–116)

Description. *Colouration.* Overall body colour varies from ochraceous to dark brown, probably depending on maturity; genae with central shiny brown or black areas, as in *C. filiverpatum*.

Structure. ♂. Similar to *C. filiverpatum.* Antennal flagellum relatively longer, 4·70–5·36 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·2 : 1·4 : 1·8 : 0·5 : 0·2; ultimate rostral segment relatively shorter, 0·32–0·40 times as long as third antennal segment and 1·48–1·98 times longer than tenth antennal segment. Fore wing narrower, 2·89–3·24 times longer than wide; venation similar to *C. filiverpatum*, spinule arrangement as in Text-fig. 62. Proctiger (Text-fig. 114) and distal segment of aedeagus (Text-fig. 116) similar to *C. filiverpatum*; paramere (Text-figs 114, 115) on inner surface with more strongly developed apical tooth and posteroapical ridge; subgenital plate with short, broad, but well developed hypovalves (Text-fig. 114).

♀. Antennal flagellum 4·72–5·22 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·1 : 1·3 : 1·5 : 1·8 : 0·4 : 0·2; ultimate rostral segment 0·33–0·36 times as long as third antennal segment and 1·72–1·88 times longer than tenth antennal segment. Fore wing 2·91–3·06 times longer than wide. Proctiger relatively longer, 2·44–2·70 times longer than hind tibia.

Measurements (±0·01 mm, based on 5 ♂, 4 ♀). Maximum width of head, ♂ 0·97–1·13, ♀ 1·08–1·23; length of antennal flagellum, ♂ 4·57–6·00, ♀ 5·10–6·30; length of ultimate rostral segment, ♂ 0·20–0·24, ♀ 0·23–0·26; length of fore wing, ♂ 2·78–3·27, ♀ 3·23–3·46; maximum width of fore wing, ♂ 0·95–1·06, ♀ 1·09–1·19; length of hind tibia, ♂ 0·70–0·75, ♀ 0·71–0·79; length of ♀ proctiger, 1·86–2·03.

HOST PLANT. Unknown.

Holotype ♂, NIGERIA: SE. State, Onya, 17.iii.1971 (*J. T. Medler*) (BMNH, London); dry mounted.

Paratypes. NIGERIA: 1 ♂, 5 ♀, Obudu CR, 21.iii.1971; 2 ♂, Ikom, 4.iv.1975; 1 ♂, W. State, Owena FR, 15.iii.1970; 2 ♀, Ile–Ife, 30.x.1968; 1 ♀, 30.x.1969; 1 ♂, 15.i.1970; 1 ♀, 26.ii.1970; 3 ♂, 29.xii.1970; 2 ♂, 2 ♀, 25.x.1971; 2 ♂, 1 ♀, 30.xii.1971; 1 ♀, Erin-Odo, 20.ii.1970 (*J. T. Medler*); 1 ♂, Erin-Odo, Waterfall, 17.iii.1972 (*E. W. Classey*) (BMNH, London); slide and dry mounted.

DISCUSSION. See preceding species.

***Ciriacremum relatum* sp. n.**

(Text-figs 61, 117–119)

DESCRIPTION. *Colouration.* Overall body colour and pattern very similar to *C. filiverpatum* but genal humps hardly darkened.

Structure. ♂. Larger, more robust and a little more densely haired than *C. filiverpatum.* Antennal flagellum 5·79–5·97 times longer than width of head, relative lengths of flagellar segment from base to apex – 1·0 : 0·9 : 1·1 : 1·3 : 1·6 : 2·1 : 0·5 : 0·2; ultimate rostral segment 0·46–0·49 times as long as third antennal segment and 2·25–2·34 times longer than tenth antennal segment. Fore wing 2·62–2·73 times longer than wide; *Cu* stem only about one and a half times longer than *M+Cu* stem; first cubital cell elongate, more than twice as long as wide; spinule arrangement as in Text-fig. 61. Paramere (Text-figs 117–118) less robust than in *C. filiverpatum* and the apical teeth and ridge are less well developed; subgenital plate has reduced but clearly developed hypovalves (Text-fig. 117).

♀. Larger than ♂. Antennal flagellum 5·55–6·12 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·3 : 1·8 : 2·3 : 0·5 : 0·2; ultimate rostral segment 0·47–0·49 times as long as third antennal segment and 1·92–2·15 times longer than 10th antennal segment. Fore wing 2·65–2·72 times longer than wide. Ovipositor long, proctiger 2·02–2·08 times longer than hind tibia.

Measurements (±0·01 mm, based on 4 ♂ and 3 ♀). Maximum width of head, ♂ 1·26–1·31, ♀ 1·30–1·37; length of antennal flagellum, ♂ 7·37–7·60, ♀ 7·60–7·95; length of ultimate rostral segment, ♂ 0·42–0·43, ♀ 0·41–0·42; length of fore wing, ♂ 3·42–3·51, ♀ 3·78–3·95; maximum width of fore wing, ♂ 1·26–1·32. ♀ 1·43–1·46; length of hind tibia, ♂ 1·02–1·09, ♀ 1·02–1·08; length of ♀ proctiger, 2·08–2·24.

HOST PLANT. Unknown.

Holotype ♂, NIGERIA: SE. State, Ikom, 4.iv.1975 (*J. T. Medler*) (BMNH, London); dry mounted.

Paratypes. NIGERIA: 7 ♂, 14 ♀, same data as holotype; 2 ♂, 4 ♀, Oban, 7.iv.1975; 2 ♂, MW. State, Udo FR, 11.iv.1975; 1 ♂, W. State, Owena, 15.ii.1970 (*J. T. Medler*) (BMNH, London; and ZI, Leningrad); slide and dry mounted.

DISCUSSION. See *C. filiverpatum* Enderlein (p. 30).

Ciriacremum kleinielloides **sp. n.**

(Text-fig. 63)

DESCRIPTION. ♂. Unknown.

♀. Similar to *C. filiverpatum*. Antennal flagellum 4·27 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·1 : 1·5 : 1·7 : 2·3 : 0·5 : 0·3; ultimate rostral segment very long, 0·65 times as long as third antennal segment and 2·6 times longer than tenth antennal segment. Fore wing elongate, 2·69 times longer than wide; pterostigma sessile, broadly trapezoidal; first cubital cell shorter, about one and a half times longer than wide; *Cu* stem more than three times longer than *M+Cu* stem; spinule arrangement as in Text-fig. 63. Ovipositor of moderate length, proctiger 1·89 times longer than hind tibia.

Measurements (±0·01 mm, based on 1 ♀). Maximum width of head, ♀ 1·13; length of antennal flagellum, ♀ 4·81; length of ultimate rostral segment, ♀ 0·34; length of fore wing, ♀ 3·29; maximum width of fore wing, ♀ 1·23; length of hind tibia, ♀ 0·87; length of ♀ proctiger, 1·63.

HOST PLANT. Unknown; collected at light by waterfall.

Holotype ♀, ANGOLA: Cachoeiras, 20 mls [32 km] SW. Gabela, 18–19.iii.1972, at light (*BM Southern Africa Expedition*) (BMNH, London); slide mounted.

DISCUSSION. This species is unusual for the genus *Ciriacremum* as the fore wing pterostigma is sessile, as in the genus *Kleiniella*. However, other characters suggest it is placed more naturally in *Ciriacremum*. The head and wing shape are similar to *C. filiverpatum* but *C. kleinielloides* may be distinguished from that species by the relative proportions of the *Cu* stem to the *M+Cu* stem, the shape of the first cubital cell and the shorter ovipositor.

Ciriacremum nigripes **sp. n.**

(Text-figs 35, 65, 120–122)

DESCRIPTION. *Colouration.* Overall body colour ochraceous and green; ocelli orange; fore wing hyaline; apical segment of fore tarsus brown or black; abdomen creamy white ventrally.

Structure. ♂. Medium size. Genal cones small but clearly developed (Text-fig. 35); antenna long, flagellum 4·90–5·26 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·4 : 1·4 : 2·0 : 0·4 : 0·2; ultimate rostral segment short, 0·29–0·32 times as long as third antennal segment and 1·23–1·36 times longer than tenth antennal segment. Fore wing 2·49–2·63 times longer than wide, spinule arrangement as in Text-fig. 65; pterostigma elongate; *Cu* stem almost three times longer than $M+Cu$ stem; Cu_1 shallowly parabolic and first cubital cell about twice as long as wide. Proctiger (Text-fig. 120) with simple basal part and a moderately long and narrow apical part; paramere (Text-figs 120, 121) compressed with truncate apex, on inner surface in apical half with a transverse apical ridge, a small group of antero-ventrally directed setae and a large group of postero-ventrally directed setae, basal part with a posterior process bearing a large group of posteriorly directed hairs; distal segment of aedeagus as in Text-fig. 122; subgenital plate with short broad hypovalves (Text-fig. 120).

♀. Antennal flagellum 4·95–5·42 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·4 : 1·5 : 2·0 : 0·4 : 0·2; ultimate rostral segment 0·30–0·35 times as long as third antennal segment and 1·27–1·39 times longer than tenth antennal segment. Fore wing 2·53–2·62 times longer than wide. Proctiger moderately long, 1·58–1·76 times longer than hind tibia.

Measurements (±0·01 mm, based on 5 ♂ and 5 ♀). Maximum width of head, ♂ 0·77–0·87, ♀ 0·84–0·91; length of antennal flagellum, ♂ 4·18–4·52, ♀ 4·18–4·62; length of ultimate rostral segment, ♂ 0·15–0·16, ♀ 0·15–0·17; length of fore wing, ♂ 2·75–3·11, ♀ 2·97–3·28; maximum width of fore wing, ♂, 1·08–1·23, ♀ 1·14–1·30; length of hind tibia, ♂ 0·65–0·67, ♀ 0·64–0·70; length of ♀ proctiger, 1·08–1·19.

HOST PLANT. Unknown.

Holotype ♂, NIGERIA: SE. State, Obudu CR, 13.iv.1973 (*J. T. Medler*) (BMNH, London); dry mounted.

Paratypes. NIGERIA: 2 ♂, same data as holotype; 12 ♂, 5 ♀, 21.iii.1971; 3 ♂, 3 ♀, Onya, 17.iii.1971; 26 ♂, Oban, 7.iv.1975; 18 ♂, 9 ♀, EC. State, Umuahia, 10.iv.1973; 16 ♂, 3 ♀, MW. State, Udo FR, 11.iv.1975; 1 ♂, W. State, Ile–Ife, 26.ii.1970; 1 ♂, NW. State, Bida CRH, 1.ix.1970 (*J. T. Medler*); 1 ♀, Ibadan, 9.iv.1966, at light trap (*Dept. Agric. Res.*); 1 ♀, Lagos, Ikoyi, 7.iii.1975 (*M. A. Cornes*) (BMNH, London; MRAC, Tervuren; and USNM, Washington); slide and dry mounted.

DISCUSSION. *C. nigripes* sp. n. and the following species have very similar general body form and fore wing shape and venation but both species have distinctive male and female genitalia and are probably not very closely related. In *C. nigripes* the general form and chaetotaxy of the male paramere is unlike any other species in the genus although it has the postero-basal sensory patch of hairs common in *Ciriacremum* species.

Ciriacremum nigeriense sp. n.

(Text-figs 36, 66, 123–125, 189)

DESCRIPTION. *Colouration.* Overall body colour very similar to *C. nigripes* but apical segment of fore tarsus ochraceous.

Structure. ♂. Very similar to *C nigripes*. Antennal flagellum shorter, 4·0–4·68 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·2 : 1·3 : 1·3 : 1·5 : 0·4 : 0·2; ultimate rostral segment 0·29–0·39 times as long as third antennal segment and 1·18–1·5 times longer than tenth antennal segment. Fore wing slightly more elongate, 2·58–2·78 times longer than wide, spinule arrangement as in Text-fig. 66. Proctiger (Text-fig. 123) with relatively longer apical part; paramere (Text-figs 123, 124) thumb-like with subconical apex, inner surface in apical half with a diagonal row of five to seven antero-ventrally directed setae and a small tooth posteriorly; distal segment of aedeagus as in Text-fig. 125; hypovalves short and narrow (Text-fig. 123).

♀. Larger than ♂. Antennal flagellum 4·34–4·72 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·3 : 1·3 : 1·5 : 0·4 : 0·2; ultimate rostral segment 0·33–0·38 times as long as third antennal segment and 1·18–1·53 times longer than tenth antennal segment. Fore wing 2·76–2·91 times longer than wide. Ovipositor (Text-fig. 189) elongated in apical half with the ventral valves thickened, proctiger 2·22–2·49 times longer than hind tibia.

Measurements (±0·01 mm, based on 7 ♂ and 6 ♀). Maximum width of head, ♂ 0·69–0·81, ♀ 0·77–0·84; length of antennal flagellum, ♂ 2·74–3·82, ♀ 3·46–3·91; length of ultimate rostral segment, ♂ 0·13–0·15, ♀ 0·14–0·16; length of fore wing, ♂ 2·27–2·83, ♀ 2·84–3·24; maximum width of fore wing, ♂ 0·83–1·03, ♀ 1·01–1·14; length of hind tibia, ♂ 0·48–0·64, ♀ 0·54–0·65; length of ♀ proctiger, 1·34–1·45.

HOST PLANT. Unknown.

Holotype ♂, NIGERIA: SE. State, Ikom, 4.iv.1975 (*J. T. Medler*) (BMNH, London); dry mounted.

Paratypes. NIGERIA: 22 ♂, 16 ♀, same data as holotype; 2 ♂, Onya, 17.iii.1971; 1 ♂, Obudu CR, 13.iv.1973; 22 ♂, 2 ♀, Oban, 7.iv.1975; 1 ♂, 2 ♀, EC. State, Umuahia, 10.iv.1973; 3 ♂, MW. State, Udo FR, 11.iv.1975; 1 ♀, W. State, Ile–Ife, 25.iii.1969 (*J. T. Medler*) (BMNH, London; MRAC, Tervuren; and USNM, Washington) slide and dry mounted.

DISCUSSION. Superficially *C. nigeriense* sp. n. resembles the preceding species but the male genitalia are of a very different form. The paramere lacks a posterobasal sensory patch of hairs and is a relatively simple, thumb-like structure, much more like that found in the genus *Kleiniella*. The form of the female ovipositor is unique among the known members of the tribe and suggests that *C. nigeriense* lays its eggs in an unusual site. A similarly modified ovipositor is found in *Psylla loranthi* Capener, 1973, and that author mentions that the long ovipositor enables the female of *P. loranthi* to penetrate the calyx of the *Loranthus* flower and deposit eggs on the style.

Ciriacremum angolense sp. n.

(Text-figs 37, 64, 91, 126–128)

DESCRIPTION. ♂. Medium size. Genae moderately developed (Text-fig. 37); antenna long, flagellum 4·19 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·2 : 1·5 : 1·7 : 1·9 : 0·5 : 0·2; ultimate rostral segment short, 0·36 times as long as third antennal segment and 1·40 times longer than tenth antennal segment. Fore wing ellipsoid, broad, 2·39 times longer than wide, spinule arrangement as in Text-fig. 64; *Cu* stem slightly more than twice as long as $M+Cu$ stem; Cu_1 steeply parabolic and first cubital cell hardly longer than wide. Proctiger (Text-fig. 126) with simple basal part and a short narrow apical part; paramere (Text-figs 126, 127) compressed, on inner surface in upper half with a transverse subapical ridge and a number of strong downwardly directed setae, in basal part with a posterior lobe which bears a large group of short conical sensory pegs; distal segment of aedeagus as in Text-fig. 128; hypovalves (Text-fig. 126) short, narrow, with incurved apices.

♀. Unknown.

Measurements (±0·01 mm, based on 1 ♂). Maximum width of head, ♂ 0·95; length of antennal flagellum, ♂ 3·97; length of ultimate rostral segment, ♂ 0·16; length of fore wing, ♂ 3·16; maximum width of fore wing, ♂ 1·32; length of hind tibia, ♂ 0·71.

Host plant. Unknown; the single known specimen was collected at a light trap by a waterfall.

Holotype ♂, Angola: Cachoeiras, 20 mls [32 km] SW. Gabela, 18–19.iii.1972, at light (*BM Southern Africa Expedition*) (BMNH, London); slide mounted.

Discussion. The affinities of this species are obscure. It has a very distinctive fore wing shape and venation and the male genitalia are quite unlike any other known species in the genus. In particular the male paramere has retained the postero-basal sensory patch but the setae are modified to short, thick sense cones. The form of the distal segment of the aedeagus is similar to that found in *Ciriacremum capense* and *Kleiniella medleri*.

Ciriacremum capillicorne Enderlein, 1918 **comb. rev.**

Ciriacremum capillicorne Enderlein, 1918 : 483, figs D, E. Holotype ♂, Cameroun: 'Kamerun. Mitte Dezember' (? depository).
Bunoparia capillicornis (Enderlein) Enderlein, 1926 : 397.

Description. (Partly translated from original description and interpreted from original figures.) Genae and anterior margin of vertex whitish, anterior half of vertex black, posterior half dirty yellow. Median suture sharp. Eyes almost round, large, black. Antenna more than twice as long as body, very flimsy, with almost complete covering of very short hairs, dark brown, first three segments brown-black. Thorax red-brown, prothorax dark brown, sternum dirty yellow. Abdomen brown-black, dorsally without hairs, ventrally with moderately thick silver-white hairs, those of ninth sternite very short. First tergite with chitinous yellow cone-like hump. Subgenital plate (original fig. D) without hypovalves. Parameres unusually long and slender, dark brown, each one apically with an inwardly directed tooth-like spine. Basal part of proctiger with elongate triangular lateral expansions. Fore wing (original fig. E) hyaline, pterostigma short, *Cu* stem about twice as long as *M*+*Cu* stem, Cu_1 steeply parabolic, first cubital cell slightly longer than wide.

Measurements (from original description). ♂, length of body, 3 mm; antenna 6·2 mm; fore wing length, 3 mm.

Host plant. Unknown.

Discussion. *C. capillicorne* is only known from the male holotype which could not be traced. From the original description and figures it is difficult to relate this species within the genus but it would appear to resemble *C. capense* as it lacks hypovalves, the basal part of the proctiger has triangular lateral expansions and the paramere is a relatively simple elongate conical structure without a postero-basal sensory patch. It apparently differs from *C. capense* in its very long antennae.

Ciriacremum capense Enderlein, 1923 **comb. rev.**

(Text-figs 47, 81, 132–134)

Ciriacremum capense Enderlein, 1923 : 543. Holotype ♀, South Africa: 'Süd-Afrika Capland, East London, Lightfoot, Juli 1914' (SAM, Cape Town).
Bunoparia capensis (Enderlein) Enderlein, 1926 : 397.
Bunoparia capensis (Enderlein); Capener, 1970*a* : 197.

Description. *Colouration.* Overall body colour mid brown with ochraceous and dark markings; pattern on dorsal surface of head and thorax very similar to *C. bicaudatum* (Text-fig. 7); genae brown apically and ochraceous ventrally; proepisternum ochraceous, proepimeron dark brown, meso- and metapleurae dark brown; fore wing hyaline with brown patch proximal to point where claval suture joins hind margin; legs mainly ochraceous, femora sometimes darkened medially; abdomen brown dorsally, ochraceous ventrally.

Structure. ♂. Small species. Genal cones (Text-fig. 47) moderately well developed; antenna moderately long, flagellum 2·87–3·25 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·1 : 1·4 : 1·3 : 1·5 : 0·5 : 0·3; ultimate rostral segment short, 0·42–0·52 times as long as third antennal segment and 1·24–1·57 times longer than tenth antennal segment. Fore wing broadly ellipsoid, 2·25–2·37 times longer than wide, spinule arrangements as in Text-fig. 81; pterostigma short and broad; Cu stem about one and two-thirds longer than $M+Cu$ stem; Cu_1 steeply parabolic and first cubital cell short, about one and one-third longer than wide. Proctiger (Text-fig. 132) with broad basal part which bears a pair of triangular lateral expansions, and a very short and narrow apical part; paramere (Text-figs 132, 133) thumb-like, on inner surface in apical half with a transverse subapical ridge which has a small tubercle at either end, and a few downwardly directed setae, basal part with a very poorly defined postero-basal group of setae; distal segment of aedeagus as in Text-fig. 134; subgenital plate (Text-fig. 132) without hypovalves.

♀. Slightly larger than ♂. Antennal flagellum 2·77–3·12 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·1 : 1·3 : 1·3 : 1·5 : 0·5 : 0·3; ultimate rostral segment 0·42–0·52 times as long as third antennal segment and 1·26–1·91 times longer than tenth antennal segment. Fore wing 2·24–2·41 times longer than wide. Ovipositor short, proctiger, 1·28–1·41 times longer than hind tibia.

Measurements (±0·01 mm, based on 7 ♂ and 6 ♀). Maximum width of head, ♂ 0·72–0·82, ♀ 0·78–0·90; length of antennal flagellum, ♂ 2·24–2·56, ♀ 2·43–2·80; length of ultimate rostral segment, ♂ 0·12–0·14, ♀ 0·13–0·15; length of fore wing, ♂ 2·06–2·44, ♀ 2·26–2·70; maximum width of fore wing, ♂ 0·89–1·08, ♀ 0·95–1·20; length of hind tibia, ♂ 0·49–0·57, ♀ 0·50–0·61; length of ♀ proctiger, 0·71–0·85.

HOST PLANTS. Restricted to native South African species of the genus *Schotia*: *S. speciosa* Jacqin, *S. latifolia* Jacqin and *S. brachypetala* Sonder.

MATERIAL EXAMINED.

SOUTH AFRICA: Transvaal, Boyne, 15–17.xii.1973; 6 ♂, 7 ♀, Pretoria, 5.iii.1964, *Schotia brachypetala* (*A. L. Capener*); 1 ♂, Kruger NP, Oliphants camp, 7.viii.1974, swept; 1 ♂, Skukusa, 8.viii.1974, swept (*B. R. Pitkin*); 1 ♂, 3 ♀, several larvae, Swaziland, Umbduzi R., 3.x.1967, *Schotia brachypetala* (*H. D. Catling*); 30 ♂, 30 ♀, several larvae, Natal (Zululand), Umfolozi GR, 25.viii.1971, *Schotia brachypetala* (*H. P. Insley*); 1 ♂, Cape Province, Mossel Bay, i. 1922; 1 ♂, Somerset East, ix. 1930; 3 ♀, Katberg, xii. 1932–ii. 1933 (*R. E. Turner*); 4 ♂, 4 ♀, van Stadens Pass, 27.x.1964, *Schotia latifolia*; 1 ♂, 1 ♀, Knysna, 18.x.1964; 1 ♂, Bathurst, 9.ii.1966; 1 ♂, 1 ♀, Port Alfred, 7.ii.1966 (*A. L. Capener*); 3 ♂, 2 ♀, several larvae, 31.i.1972, *Schotia afra* (*V. C. Moran*).

DISCUSSION. *C. capense* is the only known species in the whole group to have extended into temperate southern Africa. It displays some distinctive features particularly with respect to wing venation and the male genitalia. The male subgenital plate lacks hypovalves, the paramere is a relatively simple structure and the proctiger has lateral expansions, similar to *Kleiniella* species. Furthermore the distal segment of the aedeagus is similar to that of *K. medleri*. The chorological, morphological and host plant evidence suggests that *C. capense* has been isolated from the bulk of *Ciriacremum* species for some time.

***Ciriacremum funestum* sp. n.**

(Text-figs 46, 82, 92, 129–131)

Description. *Colouration.* Overall body colour green or ochraceous; fore wing hyaline.

Structure. ♂. Medium size. Genal cones poorly developed (Text-fig. 46); antennal flagellum moderately long, 2·81–3·07 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·6 : 2·0 : 0·6 : 0·4; ultimate rostral segment relatively long, 2·09–2·50 times longer than tenth antennal segment, third antennal segment 1·08–1·23 times longer than ultimate rostral segment. Fore wing relatively broad, 2·39–2·49 times longer than wide, pterostigma punctiformly sessile, strongly developed and causing the costa to bulge outwards, *Cu* stem about one and three-fifths longer than $M+Cu$ stem, Cu_1 steeply parabolic and first cubital cell hardly longer than wide, spinule arrangement as in Text-fig. 82. Proctiger (Text-fig. 129) with simple basal part and moderately long and narrow apical part; paramere (Text-figs 129, 130) laterally flattened with broad basal half, narrow apical half and a postero-basal lobe, inner surface with an apical tooth and a poorly developed medial sensory patch of hairs; distal segment of aedeagus as in Text-fig. 131; hypovalves (Text-fig. 129) simple, narrow, about as long as paramere.

♀. Antennal flagellum 2·59–2·98 times longer than width of head, relative lengths of segments from base to apex – 1·0 - 1·0 : 1·2 : 1·5 : 1·7 : 2·1 : 0·7 : 0·4; ultimate rostral segment 2·23–2·39 times longer than tenth antennal segment, third antennal segment 1·04–1·22 times longer than ultimate rostral segment. Fore wing 2·35–2·47 times longer than wide, costal bulge at pterostigma less developed than in ♂. Ovipositor relatively short, proctiger 1·47–1·56 times longer than hind tibia.

Measurements (±0·01 mm, based on 7 ♂ and 6 ♀). Maximum width of head, ♂ 0·78–0·86, ♀ 0·79–0·93; length of antennal flagellum, ♂ 2·32–2·43, ♀ 2·26–2·40; length of ultimate rostral segment, ♂ 0·21–0·25, ♀ 0·21–0·25; length of fore wing, ♂ 2·18–2·47, ♀ 2·17–2·61; maximum width of fore wing, ♂ 0·90–1·02, ♀ 0·89–1·09; length of hind tibia, ♂ 0·60–0·66, ♀ 0·58–0·66; length of ♀ proctiger, 0·87–1·02.

Host plant. Unknown.

Holotype ♂, Nigeria: SE. State, Ikom, 4.iv.1975 (*J. T. Medler*) (BMNH, London); dry mounted.

Paratypes. Nigeria: 27 ♂, 20 ♀, same data as holotype; 3 ♂, 1 ♀, Oban, 7.iv.1975; 1 ♀, Obudu CR, 17.iii.1973; 1 ♂, 1 ♀, EC. State, Umuahia, 10.iv.1973 (*J. T. Medler*) (BMNH, London; NCI, Pretoria; and USNM, Washington); slide and dry mounted.

Discussion. *C. funestum* sp. n. is an interesting species having characters common to both *Kleiniella* and *Ciriacremum*. It has the sessile pterostigma and long wing-vein hairs of *Kleiniella* but the short antennal hairs, grouped hind wing costal setae, grouped hind tibial spurs, and male hypovalves of *Ciriacremum*. The presence of these hypovalves indicates that this species belongs in the latter genus. The male paramere is most unusual in having a clearly developed postero-basal lobe, and the strongly developed pterostigma with a corresponding costal bulge is also remarkable.

***Ciriacremum bicaudatum* Enderlein, 1918 comb. rev.**

(Text-figs 2, 6, 7, 9, 10, 14–18, 38, 67, 68, 138–141, 191)

Ciriacremum bicaudatum Enderlein, 1918 : 482, fig. C. Syntypes ♂ and ♀, Tanzania: 'Deutsches Ost-Afrika, November' (? depository).

Bunoparia bicaudata (Enderlein) Enderlein, 1926 : 397.

Description. *Colouration.* Overall body colour brown with dark brown and ochraceous markings; dorsum of head and thorax with pattern as in Text-fig. 7; head dark brown ventrally;

proepisternum ochraceous, proepimeron dark brown, meso- and metapleurae dark brown; fore wing hyaline, rarely with brown infuscation distally, apices of veins brown, marginal cells with median apical brown spots; femora dark brown, ochraceous basally and apically; tibiae and basitarsi ochraceous, apical tarsal segments brown; abdomen red-brown dorsally, yellow laterally but with a red median longitudinal stripe, dark brown ventrally; ♂ proctiger brown basally and red apically, hypovalves dark brown; ovipositor dark brown.

Structure. ♂. Medium size. Genal cones moderately well developed (Text-fig. 38); antenna moderately long, flagellum 2·61–3·36 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·5 : 1·6 : 0·6 : 0·3; ultimate rostral segment short, 1·37–1·92 times longer than tenth antennal segment, third antennal segment 1·69–2·14 times longer than ultimate rostral segment. Fore wing ellipsoid, 2·44–2·65 times longer than wide, spinule arrangement as in Text-figs 67, 68; pterostigma long, *Cu* stem about twice as long as $M+Cu$ stem, first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 138) with simple basal part and a very long narrow apical part; paramere (Text-figs 138–140) compressed, with broad basal part and a long narrow apical part, on inner surface with an apical tooth and a large postero-medial toothed ridge which bears a group of downwardly directed setae, ventral half bears a group of postero-ventrally directed setae; hypovalves long and broad (Text-figs 138, 139) with a poorly defined medial hump bearing a few barely modified setae, on inner posterior surface with a moderately developed vertical row of inwardly directed curved setae; distal segment of aedeagus (Text-fig. 141) with a narrow apex.

♀. Slightly larger than ♂. Antennal flagellum 2·78–3·03 times longer than head width, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·6 : 1·6 : 0·6 : 0·3; ultimate rostral segment 1·33–1·67 times longer than tenth antennal segment, third antennal segment 1·67–2·14 times longer than ultimate rostral segment. Fore wing 2·39–2·66 times longer than wide. Ovipositor relatively long (Text-fig. 191), proctiger 1·67–2·14 times longer than hind tibia.

Measurements (±0·01 mm, based on 14 ♂ and 8 ♀). Maximum width of head, ♂ 0·72–0·94, ♀ 0·82–0·94; length of antennal flagellum, ♂ 2·30–2·78, ♀ 2·33–2·80; length of ultimate rostral segment, ♂ 0·14–0·18, ♀ 0·14–0·16; length of fore wing, ♂ 2·60–3·10, ♀ 2·82–3·25; maximum width of fore wing, ♂ 0·99–1·20, ♀ 1·12–1·31; length of hind tibia, ♀ 0·65–0·75, ♀ 0·67–0·75; length of ♀ proctiger, 1·29–1·56.

HOST PLANT. Unknown.

MATERIAL EXAMINED.

NIGERIA: EC. State, Umuahia, 1.iv.1973 (*J. T. Medler*). ZAIRE: 10 ♂, 16 ♀, Kivu, Kavimvira (Uvira), xii. 1954, at light (*G. Marlier*); 1 ♂, Elizabethville, 1953–1955, at light; 1 ♂, 1 ♀, xi. 1959, at light (*Ch. Seydel*). ANGOLA: 2 ♂, 1 ♀, Salazar, 29.xi.1972, at light; 1 ♀, viii. 1973; 1 ♀, Cela, 27.viii.1973; 11 ♂, 11 ♀, Chianga, 17.x.1972, at light; 1 ♂, 26.viii.1974, at light (*J. Passos de Carvalho*); 3 ♂, 8.ix.1963, at light (*H. Cardosa*); 2 ♀, 15–19.ix.1970, yellow trays (*A. van Harten*); 1 ♀, Tundavala, 13–16 km NW. Sa da Bandeira, 27–29.iii.1972, general sweeping (*BM Southern Africa Expedition*). MOZAMBIQUE: 2 ♂, 1 ♀, Chibuto, 29.ix.1968, on Cashew.

DISCUSSION. *C. bicaudatum* and the following eight species present a very interesting species-group. A study of the biology and systematics of the group could give some useful information to refine species concepts and understand mechanisms of speciation in tropical psyllids.

C. bicaudatum, as it is understood here, is a widespread and morphologically variable species. Its geographic range extends from southern Nigeria, through Zaire and Central Africa to Mozambique. The populations examined from either end of this range differ from much of the Central African material in that the fore wing has a more even covering of spinules on the dorsal surface (Text-figs 67, 68). Also, in the Nigerian specimens, the seventh and eighth antennal segments are relatively longer, the relative lengths of the flagellar segments being, in the ♂ – 1·0 : 1·0 ; 1·2 : 1·6 : 1·9 : 2·3 : 0·6 : 0·4, and in the ♀ – 1·0 : 1·0 : 1·2 : 1·6 : 1·7 : 2·0 : 0·6 : 0·4. The male genitalia are also subject to slight variation, particularly in the length of the hypovalves (Text-figs 138, 139).

The other eight species in the group occur both allopatrically and sympatrically with *C. bicaudatum*. *C. daubicatum* sp. n. from Ghana and *C. cabudiatum* sp. n. from the Ivory Coast would appear to be westward replacement species of *bicaudatum*, and *C. capeneri* sp. n. from Rhodesia may be a southern replacement, although *C. bicaudatum* is known from southern coastal Mozambique. *C. harteni* sp. n. *C. carvalhoi* sp. n., *C. julbernardioides* sp. n. and *C. orientale* sp. n. are sympatric with *C. bicaudatum* in *Brachystegia* woodland but may occur on different host plants. For instance *C. carvalhoi* feeds on *Hymenostegia laxiflora*, *C. julbernardioides* on species of *Julbernardia*, and *C. harteni* is found on *Brachystegia spiciformis* and *B. tamarindoides*. This point will only be verified when the host of *C. bicaudatum* is known.

The male genitalia of the *bicaudatum*-group conform to a basic plan but show modifications in different structures which reflect the various lines of evolution within the group. Taking *C. bicaudatum* as a starting point, but not necessarily suggesting this species displays the primitive condition for all attributes concerned, one can trace these patterns of radiation. In *C. bicaudatum* the paramere (Text-fig. 140) has an elongate apical part and a moderately well developed postero-medial tubercle and sensory patch of setae; the hypovalves (Text-figs 138, 139) are long, broad and paired, with a slight medial hump bearing relatively undifferentiated setae, and the inner postero-vertical setae are moderately developed. The simplest development of the state is found in *C. cabudiatum* sp. n. where the apical lobe of the paramere is shortened, the postero-medial tubercle and sensory patch are slightly more developed (Text-fig. 148); and on the hypovalves (Text-fig. 147) the medial hump is a little more developed with slightly more differentiated setae, and the inner postero-vertical row of setae is very much more developed. *C. daubicatum* represents a more derived condition along this line as the hypovalves have become elongate and slender, the medial hump is well developed and bears strongly differentiated setae, and the postero-vertical row of setae is very well developed (Text-figs 142, 143). In *C. carvalhoi* the thinner apical part of the hypovalve is lost but the specialized setae are retained in a subapical position (Text-fig. 161); in *C. harteni* the specialized setae are replaced by a tubercle (Text-fig. 165); and in *C. capeneri* the hypovalves have fused distally to form a single posterior structure (Text-figs 168, 170) with each half bearing a group of specialized setae on a tubercle.

C. tubacadium has evolved along a different line. In this species the hypovalves have a less developed postero-vertical row of setae but on the paramere the apical lobe is reduced and the postero-medial sensory patch of setae is extended vertically along the inner posterior margin so forming an equivalent setal arrangement to the hypovalves of *C. bicaudatum* (Text-figs 150, 151).

C. julbernardioides and *C. orientale* have similar paramere and hypovalve structures to *C. bicaudatum* but the apical part of the proctiger is reduced. These two species have heavily spinuled fore wings (Text-figs 75, 76), quite unlike any other Ethiopian species, and apparently breed on *Julbernardia* species rather than *Brachystegia*.

Ciriacremum daubicatum **sp. n.**

(Text-figs 39, 69, 142–145)

Description. ♂. Very similar to *C. bicaudatum*. Antennal flagellum 3·00–3·12 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·6 : 1·8 : 0·6 : 0·3; ultimate rostral segment 1·65 times longer than tenth antennal segment, third antennal segment 1·74–1·94 times longer than ultimate rostral segment. Fore wing 2·52–2·66 times longer than wide, spinule arrangement as in Text-fig. 69; pterostigma long; *Cu* stem about two and a quarter times longer than *M* + *Cu* stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 142) with simple basal part and a very long and narrow apical part; paramere (Text-figs 142, 144) compressed, with broad basal part and moderately long and narrow apical part, on inner surface with an apical toothed ridge and well developed postero-medial toothed ridge and sensory patch of strongly developed setae, postero-basal patch of backwardly directed hairs moderately developed; hypovalves (Text-fig. 143) elongate, apical part hardly wider than apical part of proctiger, medial hump well developed and bearing four to five strongly developed curved setae, inner postero-vertical row of curved setae well developed; distal segment of aedeagus (Text-fig. 145) with narrow apex.

♀. Slightly larger than ♂. Ultimate rostral segment 1·60–1·77 times longer than tenth antennal segment, third antennal segment 1·67–1·87 times longer than ultimate rostral segment. Fore wing 2·5–2·6 times longer than wide. Ovipositor shorter than in *C. bicaudatum*, proctiger 1·68–1·79 times longer than hind tibia.

Measurements (±0·01 mm, based on 4 ♂ and 6 ♀). Maximum width of head, ♂ 0·84–0·92, ♀ 0·83–0·95; length of antennal flagellum, ♂ 2·52–2·74, ♀ 2·50–2·90; length of ultimate rostral segment, ♂ 0·16–0·17, ♀ 0·16–0·18; length of fore wing, ♂ 2·80–3·36, ♀ 2·97–3·34; maximum width of fore wing, ♂ 1·11–1·27, ♀ 1·17–1·33; length of hind tibia, ♂ 0·70–0·83, ♀ 0·70–0·79; length of ♀ proctiger, 1·23–1·37.

Host plant. Unknown; all specimens examined were collected at light.

Holotype ♂, Ghana: Tafo, Cocoa Res. Inst., ix. 1973, light trap (*M. A. K. Akotoye*) (BMNH, London); slide mounted.

Paratypes. Ghana: 3 ♂, 6 ♀, same data and depository as holotype; all slide mounted.

For discussion of this species see under *C. bicaudatum* (p. 38).

Ciriacremum cabudiatum **sp. n.**

(Text-figs 40, 70, 146–149)

Description. *Colouration.* Overall body colour similar to *C. bicaudatum* but pattern less well developed.

Structure. ♂. Similar to *C. bicaudatum*. Genal cones slightly more strongly developed (Text-fig. 40); antennal flagellum 3·11–3·35 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·6 : 1·6 : 1·9 : 0·6 : 0·3; ultimate rostral segment very short, 1·22–1·29 times longer than tenth antennal segment, third antennal segment 2·38—2·75 times longer than ultimate rostral segment. Fore wing 2·45–2·51 times longer than wide, spinule arrangement as in Text-fig. 70; pterostigma shorter than in *C. bicaudatum*; *Cu* stem slightly more than twice as long as *M+Cu* stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 146) with simple basal part and a long and narrow apical part; paramere (Text-figs 146, 148) compressed, narrow apical part considerably shorter than in *C. bicaudatum*, on inner surface with an apical toothed ridge and well developed postero-medial toothed ridge and sensory patch of setae, basal part with poorly defined postero-basal sensory patch of hairs; hypovalves (Text-figs 146, 147) with moderately well developed medial hump which bears moderately differentiated setae, and a well developed inner postero-vertical row of curved setae; distal segment of aedeagus (Text-fig. 149) with broad apex.

♀. Slightly larger than ♂. Antennal flagellum 3·01–3·12 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·6 : 1·7 : 1·8 : 0·6 : 0·3; ultimate rostral segment 1·23–1·26 times longer than tenth antennal segment, third antennal segment 2·31–2·58 times longer than ultimate rostral segment. Fore wing 2·40–2·49 times longer than wide. Ovipositor relatively short, proctiger 1·38–1·40 times longer than hind tibia.

Measurements (±0·01 mm, based on 5 ♂ and 3 ♀). Maximum width of head, ♂ 0·85–0·93, ♀ 0·92–0·94; length of antennal flagellum, ♂ 2·65–2·98, ♀ 2·82–2·88; length of ultimate rostral segment, ♂ 0·12–0·13, ♀ 0·12–0·13; length of fore wing, ♂ 2·80–2·94, ♀ 3·09–3·25; maximum width of fore wing, ♂ 1·13–1·19, ♀ 1·25–1·33; length of hind tibia, ♂ 0·66–0·75, ♀ 0·70–0·75; length of ♀ proctiger, 0·96–1·03.

HOST PLANT. Unknown.

Holotype ♂, IVORY COAST: Bingerville, ix. 1962 (*J. Decelle*) (MRAC, Tervuren); dry mounted.

Paratypes. IVORY COAST: 7 ♂, 8 ♀, same data as holotype. NIGERIA: 1 ♂, 1 ♀, SE. State, Ikom, 4.iv.1975 (*J. T. Medler*) (MRAC, Tervuren; BMNH, London); slide and dry mounted.

For discussion of this species see under *C. bicaudatum* (p. 38).

***Ciriacremum carvalhoi* sp. n.**

(Text-figs 44, 73, 160–163)

DESCRIPTION. *Colouration.* Overall body colour ochraceous-green with light or dark brown markings; apices of genal cones red-brown; mesopraescutum with a pair of brown patches antero-medially; mesoscutum with two pairs of broad longitudinal brown bands; fore wing hyaline with a small brown spot proximal to point where claval suture joins hind margin; fore and mid femora dark brown ventrally; abdomen with median longitudinal dorsal brown stripe, proctiger with broad brown spot dorsally near junction between basal and apical parts.

Structure. ♂. Similar to *C. bicaudatum*. Genal cones (Text-fig. 44) well developed; antennal flagellum 2·81–3·14 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·6 : 1·8 : 0·6 : 0·3; ultimate rostral segment relatively short, 1·05–1·42 times longer than tenth antennal segment, third antennal segment 2·18–2·82 times longer than ultimate rostral segment. Fore wing 2·40–2·58 times longer than wide, spinule arrangement as in Text-fig. 73; pterostigma relatively short, *Cu* stem about one and one-third longer than *M+Cu* stem; first cubital cell about one and one-third longer than wide. Proctiger (Text-fig. 160) with simple basal part and moderately long and narrow apical part; paramere (Text-figs 160, 162) compressed, with short narrow apical part, inner surface with an apical toothed ridge, a moderately well developed postero-medial toothed ridge and sensory patch of well developed setae, basal part with moderately well defined postero-basal sensory patch of setae; hypovalves (Text-figs 161) relatively short, with a subapical group of four to six differentiated setae, postero-vertical row of curved setae moderately developed; distal segment of aedeagus (Text-fig. 163) with narrow apex.

♀. Slightly larger than ♂. Antennal flagellum 2·89–3·07 times longer than width of head, relative lengths of flagellar segments from base to apex – as in ♂; ultimate rostral segment 1·12–1·21 times longer than tenth antennal segment, third antennal segment 2·25–2·54 times longer than ultimate rostral segment. Fore wing 2·35–2·49 times longer than wide. Ovipositor relatively long, proctiger 1·83–1·98 times longer than hind tibia.

Measurements (±0·01 mm, based on 9 ♂ and 5 ♀). Maximum width of head, ♂ 0·77–0·87, ♀ 0·79–0·85; length of antennal flagellum, ♂ 2·16-2·71, ♀ 2·29.2·53; length of ultimate rostral segment, ♂ 0·01–0·12, ♀ 0·10–0·11; length of fore wing, ♂ 2·34–2·73, ♀ 2·54–2·83; maximum width of fore wing, ♂ 0·92–1·11, ♀ 1·02–1·18; length of hind tibia, ♂ 0·52–0·60, ♀ 0·54–0·60; length of ♀ proctiger, 1·06–1·14.

Host plant. Type-series collected from young seedlings of *Hymenostegia laxiflora* (Bentham) Harms in an old coffee forest that was reverting to the wild state.

Holotype ♂, Angola: Salazar, I.I.A.A., 9–15.iii.1972, *Hymenostegia laxiflora* (*BM Southern Africa Expedition*) (BMNH, London); dry mounted.

Paratypes. Angola: 27 ♂, 15 ♀, same data as holotype; 1 ♂, 2 ♀, at light (*BM Southern Africa Expedition*); 1 ♀, 22.ix.1972, light trap (*J. Passos de Carvalho*); 1 ♀, 5 km SW Salazar, 15.iii.1972, at light (*BM Southern Africa Expedition*). Nigeria: 1 ♂, Ile–Ife, 25.iii.1969; 1 ♂, 28.ii.1970; 1 ♀, MW. State, Benin, 20.iii.1972; 1 ♂, 1 ♀, 1.iv.1975; 2 ♂, 8.iv.1973; 2 ♀, nr Siluko, iii. 1973 (*J. T. Medler*); 1 ♂, 1 ♀, Sapoba FR, nr Benin, 10–12.iii.1972 (*E. W. Classey*). Ghana: 1 ♂, 1 ♀, Tafo (*B. M. Gerrard*). (BMNH, London; MRAC, Tervuren; and ZI, Leningrad); slide and dry mounted.

Discussion. (See also under *C. bicaudatum*, p. 38). *C. carvalhoi* is closely related to the following two species, forming with them a well defined subgroup within the *bicaudatum*-group. All three species show similar modifications of the male hypovalves (Text-figs 161, 165, 170) from the *bicaudatum*-type.

Ciriacremum harteni **sp. n.**

(Text-figs 24, 42, 72, 164–167)

Description. *Colouration.* Similar to *C. bicaudatum*. Femora and tarsal segments yellow; apical part of ♂ proctiger light brown.

Structure. ♂. Similar to *C. bicaudatum*. Genal cones less well developed (Text-fig. 42); antenna shorter, flagellum 1·91–2·23 times longer than width of head, relative lengths of flagellar segment from base to apex – 1·0 : 0·9 : 1·0 : 1·1 : 1·2 : 1·1 : 0·5 : 0·5; ultimate rostral segment relatively longer, 1·84–2·14 times longer than tenth antennal segment, third antennal segment 1·06–1·19 times longer than ultimate rostral segment. Fore wing slightly broader, 2·28–2·56 times longer than wide, spinule arrangement as in Text-fig. 72; pterostigma short; *Cu* stem slightly less than twice as long as *M*+*Cu* stem; first cubital cell one and one-quarter times longer than wide. Proctiger (Text-fig. 164) with relatively short apical part; paramere (Text-figs 164, 166) compressed, with long broad basal part and short narrow apical part, inner surface with an inner toothed ridge and a moderately developed postero-medial lobe, postero-medial and postero-basal sensory patches of hairs relatively undifferentiated; hypovalves (Text-fig. 165) similar to *C. carvalhoi* sp. n. but with a subapical tubercle; distal segment of aedeagus (Text-fig. 167) relatively short with a broad apex.

♀. Slightly larger than ♂. Antennal flagellum 1·91–2·19 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 0·9 : 1·0 : 1·1 : 1·1 :0·5 : 0·4; ultimate rostral segment 1·74–2·26 times longer than tenth antennal segment, third antennal segment 1·05–1·25 times longer than ultimate rostral segment. Fore wing 2·26–2·40 times longer than wide. Ovipositor shorter than in *C. bicaudatum*, proctiger 1·32–1·40 times longer than hind tibia.

Measurements (±0·01 mm, based on 8 ♂ and 8 ♀). Maximum width of head, ♂ 0·63–0·68, ♀ 0·66–0·75; length of antennal flagellum, ♂ 1·25–1·40, ♀ 1·34–1·57; length of ultimate rostral segment, ♂ 0·16–0·18, ♀ 0·16–0·20; Length of fore wing, ♂ 1·91–2·05, ♀ 2·06–2·45; maximum width of fore wing, ♂ 0·77–0·87, ♀ 0·88–1·06; length of hind tibia, ♂ 0·52–0·58, ♀ 0·55–0·64; length of ♀ proctiger, 0·77–0·87.

Host plants. Adults and larvae have been taken from *Brachystegia spiciformis* Bentham and *B. tamarindoides* Welwitsch ex Bentham.

Holotype ♂, Angola: Chianga, 21–24.iii.1972, *Brachystegia tamarindoides* (*BM Southern Africa Expedition*) (BMNH, London); dry mounted.

Paratypes. Angola: 20 ♂, 13 ♀, same data as holotype; 1 ♀, vi. 1970, yellow tray; 10 ♂, 14 ♀, 5–14.ix.1970, yellow tray; 5 ♂, 5 ♀, x. 1970, yellow tray; 2 ♂, xii. 1970–i. 1971; 4 ♂, 14 ♀, 31.viii.1970, *Brachystegia spiciformis*; 4 ♂, 2 ♀, several larvae, 10.x.1970; 6 ♂, 2 ♀, several larvae, Catata, 17.ii.1972, *Brachystegia tamarindoides* (*A. van Harten*); 2 ♂, 4 ♀, Tundavala, 9 mls [14.5 km] NW. Sa da Bandeira, 23.ii.1972, *Brachystegia spiciformis*; 2 ♀, 15 mls [24 km] N. Sa da Banderia, *c.* 6500′ [1981 m], 3.iii.1972, *Brachystegia spiciformis* (*BM Southern Africa Expedition*) (BMNH, London; MRAC, Tervuren; NCI, Pretoria); slide and dry mounted.

Discussion. (See also under *C. bicaudatum*, p. 38). In *C. harteni* the male hypovalves are very similar to *C. carvalhoi* but the subapical setae are replaced by a small tubercle; also the inner postero-vertical row of curved setae is more strongly developed. The paramere has undergone considerable change with the postero-medial tubercle and sensory patch relatively undifferentiated. The aedeagus is unlike any other species in the *bicaudatum* group, the distal segment being short and thick.

***Ciriacremum capeneri* sp. n.**

(Text-figs 27, 43, 74, 168–171)

Description. *Colouration.* Overall body colour and pattern similar to *C. bicaudatum*; genae completely ochraceous; femora not darkened; apical part of ♂ proctiger brown.

Structure. ♂. Similar to *C. bicaudatum*. Genal cones (Text-fig. 43) less well developed; antennal flagellum 1·82–2·40 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 - 1·2 : 1·5 : 1·4 : 1·3 : 0·6 : 0·4; ultimate rostral segment 1·35–2·03 times longer than tenth antennal segment, third antennal segment 1·17–1·61 times longer than ultimate rostral segment. Fore wing 2·47–2·68 times longer than wide, spinule arrangement as in Text-fig. 74; pterostigma long; *Cu* stem about two and a half times longer than *M*+*Cu* stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 168) with simple basal part and relatively short narrow apical part; paramere (Text-figs 168, 169) compressed, with moderately long and narrow apical part, on inner surface with apical tooth, a well developed medial toothed ridge and moderately well developed sensory patch of setae, basal part with a poorly defined sensory patch of hairs; distal segment of aedeagus (Text-fig. 171) with broad apex; subgenital plate (Text-fig. 170) with short hypovalves which are fused along their inner apical surfaces to form a single structure or hypovalvular plate, a subapical tubercle with a few short setae is present on either half of this plate on the dorsal surface, ventro-medially the inner vertical rows of curved setae are developed up to the point where the hypovalves are fused.

♀. Slightly larger than ♂. Antennal flagellum 1·97–2·18 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·4 : 1·4 : 0·7 : 0·5; ultimate rostral segment 1·49–1·86 times longer than tenth antennal segment, third antennal segment 1·21–1·42 times longer than ultimate rostral segment. Fore wing 2·36–2·69 times longer than wide. Ovipositor of moderate length, proctiger 1·56–1·69 times longer than hind tibia.

Measurements (±0·01 mm, based on 12 ♂ and 5 ♀). Maximum width of head, ♂ 0·64–0·80, ♀ 0·70–0·83; length of antennal flagellum, ♂ 1·17–1·74, ♀ 1·38–1·74; length of ultimate rostral segment, ♂ 0·12–0·16, ♀ 0·12–0·15; length of fore wing, ♂ 1·81–2·50, ♀ 1·96–2·64; maximum width of fore wing, ♂ 0·72–0·97, ♀ 0·83–1·05; length of hind tibia, ♂ 0·42–0·58, ♀ 0·43–0·57; length of ♀ proctiger, 0·67–0·90.

HOST PLANT. *Brachystegia glaucescens* Burtt Davy & Hutchinson.

Holotype ♂, RHODESIA: Rusape, vii. 1970, *Brachystegia glaucescens* (*J. McDaniel*) (NCI, Pretoria); slide mounted.

Paratypes. RHODESIA: 24 ♂, 13 ♀, several larvae, same data as holotype; 1 ♀, Salisbury, 6.vi.1958 (*C. E. Taylor*); 29 ♂, 38 ♀, 1967/1968, sticky traps (*J. R. Blowers*); 7 ♂, 3 ♀, Enterprise, 20.x.1960, on weeds in streak field-maize (*Dept. Agric.*). TANZANIA: 1 ♀, Nachingwea, x. 1953–ii. 1954, yellow tray (*V. F. Eastop*); 1 ♂, no data (probably Kenya) (BMNH, London; NCI, Pretoria); slide mounted and in 80% ethanol.

DISCUSSION. (See also under *C. bicaudatum*, p. 38.) *C. capeneri* is unlike any other species in the genus in that the male hypovalves are fused apically to form a single structure. On the general form of the male genitalia this species is clearly a member of the *bicaudatum* group and probably the most derived species of the subgroup including *C. carvalhoi* and *C. harteni*.

***Ciriacremum tubacadium* sp. n.**

(Text-figs 41, 71, 150–152)

DESCRIPTION. ♂. Very similar to *C. bicaudatum*. Antennal flagellum 2·86–3·12 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·1 : 1·2 : 1·6 : 1·7 : 1·7 : 0·7 : 0·4; ultimate rostral segment 1·52–1·58 times longer than tenth antennal segment, third antennal segment 1·71–1·92 times longer than ultimate rostral segment. Fore wing 2·55–2·72 times longer than wide, spinule arrangement as in Text-fig. 71; pterostigma long; *Cu* stem about twice as long as $M+Cu$ stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 150) with simple basal part and a long narrow apical part; paramere (Text-figs 150, 151) compressed with truncate apex, inner surface with apical tubercle, postero-medial tubercle moderately well developed, postero-medial sensory patch of setae extended vertically along inner margin of paramere, postero-lateral sensory patch of setae moderately well developed; distal segment of aedeagus (Text-fig. 152) with narrow apex.

♀. Slightly larger than ♂. Antennal flagellum 2·88–2·99 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·3 : 1·6 : 1·7 : 1·8 : 0·7 : 0·4: ultimate rostral segment 1·40–1·58 times longer than tenth antennal segment, third antennal segment 1·36–2·08 times longer than ultimate rostral segment. Fore wing 2·45–2·77 times longer than wide. Ovipositor relatively long, proctiger 2·05–2·18 times longer than hind tibia.

Measurements (±0·01 mm, based on 6 ♂ and 5 ♀). Maximum width of head, ♂ 0·71–0·77, ♀ 0·68–0·90; length of antennal flagellum, ♂ 2·17–2·31, ♀ 2·03–2·34; length of ultimate rostral segment, ♂ 0·13–0·14, ♀ 0·13–0·17; length of fore wing, ♂ 2·63–2·94, ♀ 2·50–3·16; maximum width of fore wing, ♂ 1·03–1·13, ♀ 0·96–1·24; length of hind tibia, ♂ 0·60–0·65, ♀ 0·54–0·71; length of ♀ proctiger, 1·14–1·45.

HOST PLANT. Unknown; type-series collected at light.

Holotype ♂, ANGOLA: Dundo, 10–13.viii.1953, light trap (*Luna*) (BMNH, London); slide mounted.

Paratypes. ANGOLA: 5 ♂, 4 ♀, same data and depository as holotype; slide mounted.

DISCUSSION. (See also under *C. bicaudatum*, p. 38.) *C. tubacadium* is unlike any other species in the *bicaudatum*-group because the vertical row of curved setae on the inner margins of the male hypovalves are much reduced and apparently replaced by the postero-medial sensory setae of the parameres which have become extended vertically along the inner posterior margin of each paramere.

Ciriacremum julbernardioides **sp. n.**

(Text-figs 21, 25, 45, 75, 153–156)

DESCRIPTION. *Colouration.* Overall body colour light brown with ochraceous markings; dorsum of head and thorax with pattern similar to *C. bicaudatum* but not so obvious because the ground colour is much lighter; fore wing with yellowish tinge due to heavy density of spinules, sometimes distal hind margin infuscate; legs ochraceous.

Structure. ♀. Smaller than *C. bicaudatum.* Antennal flagellum relatively short, 1·61–2·15 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·2 : 1·1 : 1·1 : 0·6 : 0·5; ultimate rostral segment 1·6–1·9 times longer than tenth antennal segment, third antennal segment 1·07–1·31 times longer than ultimate rostral segment. Fore wing relatively broad, 2·21–2·39 times longer than wide, evenly and densely covered with spinules on dorsal surface (Text-fig. 75); pterostigma long; length of *Cu* stem variable, from 1·7–2·4 times longer than *M*+*Cu* stem; first cubital cell about one and a quarter times longer than wide. Proctiger (Text-fig. 153) with simple basal part and relatively short and narrow apical part; paramere (Text-figs 153, 155) compressed, with long narrow apical part and broad basal part, on inner surface with a moderately developed apical ridge, a well developed postero-medial toothed ridge and sensory patch of setae, postero-basal sensory patch of hairs moderately well developed; distal part of aedeagus (Text-fig. 156) with broad apex; hypovalves (Text-fig. 154) shorter than in *C. bicaudatum* with inner postero-vertical row of setae developed only in basal half.

♀. Slightly larger than ♂. Antennal flagellum 1·77–2·21 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·2 : 1·1 : 1·0 : 0·5 : 0·4; ultimate rostral segment 1·6–1·8 times longer than tenth antennal segment, third antennal segment 1·06–1·44 times longer than ultimate rostral segment. Fore wing 2·18–2·37 times longer than wide. Ovipositor relatively short, proctiger 1·14–1·31 times longer than hind tibia.

Measurements (±0·01 mm, based on 15 ♂ and 10 ♀). Maximum width of head, ♂ 0·69–0·79, ♀ 0·77–0·83; length of antennal flagellum, ♂ 1·14–1·62, ♀ 1·36–1·79; length of ultimate rostral segment, ♂ 0·15–0·18, ♀ 0·16–0·18; length of fore wing, ♂ 2·05–2·54, ♀ 2·45–2·82; maximum width of fore wing, ♂ 0·89–1·13, ♀ 1·05–1·29; length of hind tibia, ♂ 0·52–0·66, ♀ 0·59–0·69; length of ♀ proctiger, 0·71–0·87.

Host plants. Larvae and adults have been collected from *Julbernardia paniculata* (Bentham) Troupin, and *J. globiflora* (Bentham) Troupin. Adults only have been collected from *Brachystegia spiciformis* Bentham.

Holotype ♂, Angola: Tundavala, 9 mls [15 km] NW. Sa da Bandeira, 23.ii.1972, beaten from *Brachystegia spiciformis* (*BM Southern Africa Expedition*) (BMNH, London); dry mounted.

Paratypes. Angola: 11 ♂, 7 ♀, same data as holotype; 1 ♂, 1 ♀, 27–29.iii.1972, general sweeping; 1 ♂, 1 ♀, 15 mls [24 km] N. Sa da Bandeira, *c.* 6500′ [1981 m], 24.ii.1972, *Brachystegia* woodland; 3 ♂, 1 ♀, 3.iii.1972, *Brachystegia spiciformis* (*BM Southern Africa Expedition*); 2 ♂, 3 ♀, Chianga, 7–9.ix.1966, at light; 3 ♂, 5 ♀, several larvae, 15.ix.1970, *Julbernardia paniculata*; 1 ♂, 15–19.ix.1970, yellow tray (*A. van Harten*); 30 ♂, 43 ♀, 17.x.1972, at light; 1 ♂, 2 ♀, Cela, x. 1972, at light; 1 ♂, 27.iii.1973 (*J. Passos de Carvalho*); 6 ♂, 6 ♀, Ceilunga, 8.x.1972, at light (*M. Umbelina*); 3 ♂, 1 ♀, several larvae, Nharea, 6.x.1974, *Julbernardia paniculata* (*A. van Harten*). Zaire: 1 ♂, 3 ♀, Elizabethville, 17.x.1923 (*Ch. Seydel*). Rhodesia: 1 ♂, 1 larva, Salisbury, 12.i.1958, lucerne, bred on peas; 1 ♂, 18–19.x.1958, yellow trays; 1 ♂, xi. 1958, yellow tray; 3 ♂, 1 ♀, v. 1959, yellow tray (*C. E. Taylor*); 6 ♂, 6 ♀, several larvae, i. 1968, *Julbernardia globiflora* (*J. R. Blowers*) (BMNH, London; MRAC, Tervuren; NCI, Pretoria; ZI, Leningrad); slide and dry mounted, and stored in 80% ethanol.

Discussion. (See also under *C. bicaudatum*, p. 38.) *C. julbernardioides* is closely related to the following species and the two are regarded here as sister species. On the structure of the male genitalia they are obviously members of the *bicaudatum*-group but both are easily distinguished because the membrane of the fore wing is evenly and densely covered with spinules on the dorsal surface.

***Ciriacremum orientale* sp. n.**

(Text-figs 21, 76, 157–159)

Description. ♂. Very similar to *C. julbernardioides*. Antennal flagellum shorter, 1·27–1·43 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·8 : 0·9 : 1·0 : 0·9 : 0·9 : 0·5 : 0·4; ultimate rostral segment 1·87–2·50 times longer than tenth antennal segment, third antennal segment 0·93–1·00 times longer than ultimate rostral segment. Fore wing 2·12–2·27 times longer than wide. Proctiger (Text-fig. 157) with shorter narrow apical part; paramere (Text-figs 157, 158) with short narrow apical part and less well developed postero-medial ridge; distal segment of aedeagus (Text-fig. 159) with narrower apex; hypovalves relatively shorter, with inner postero-vertical row of setae not at all developed.

♀. Slightly larger than ♂. Antennal flagellum 1·23–1·36 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·8 : 0·9 : 0·9 : 1·0 : 0·9 : 0·6 : 0·6; ultimate rostral segment 1·50–1·75 times longer than tenth antennal segment, third antennal segment 1·0–1·14 times longer than ultimate rostral segment. Fore wing 2·13–2·29 times longer than wide. Ovipositor shorter than in *C. julbernardioides*, proctiger 1·00–1·22 times longer than hind tibia.

Measurements (±0·01 mm, based on 8 ♂ and 6 ♀). Maximum width of head, ♂ 0·67–0·73, ♀ 0·78–0·80; length of antennal flagellum, ♂ 0·85–1·00, ♀ 0·96–1·07; length of ultimate rostral segment, ♂ 0·15–0·17, ♀ 0·14; length of fore wing, ♂ 1·80–2·16, ♀ 2·34–2·57; maximum width of fore wing ♂ 0·80–0·98, ♀ 1·06–1·19; length of hind tibia, ♂ 0·52–0·62, ♀ 0·55–0·59; length of ♀ proctiger, 0·59–0·71.

Host plant. Unknown.

Holotype ♂, Tanzania: Nachingwea, x. 1953–ii. 1954, yellow tray (*V. F. Eastop*) (BMNH, London); slide mounted.

Paratypes. Tanzania: 5 ♂, 2 ♀, same data as holotype. East Africa [Kenya coast]: 2 ♂, Myombo [Swahili for *Brachystegia* woodland], 13.iii.1914. Mozambique: 4 ♀, 9 mls [14·5 km] NW. Dondo, 11.xi.1967 (*H. D. Brown*) (BMNH, London; NCI, Pretoria); all slide mounted.

Discussion. The genetic relationship between *C. julbernardioides* and *C. orientale* presents an interesting problem at the species level that cannot be clearly resolved without further information on the biology and distribution of these two so-called species.

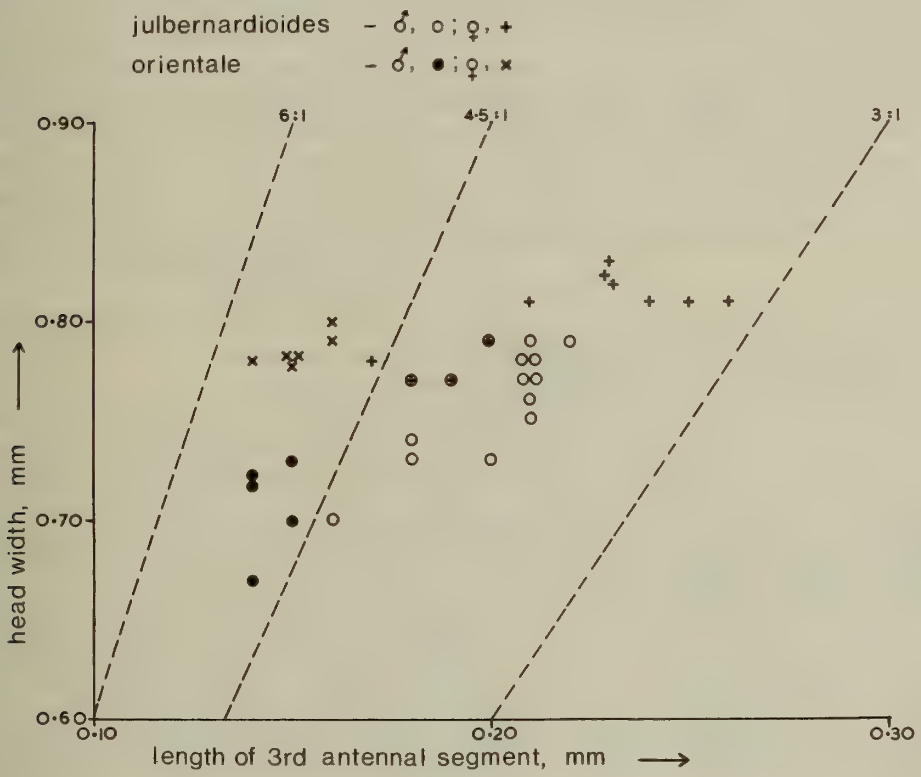


Fig. 21. Scatter diagram comparing head width against length of third antennal segment in *Ciriacremum julbernardioides* and *C. orientale*.

It is suggested here that *C. julbernardioides* and *C. orientale* form a sister pair of species separable, morphologically, on the structure of the male genitalia (Text-figs 153–159) and on the relative proportions of the antennal flagellum to head width (Text-fig. 21). *C. julbernardioides* is a widespread species occurring from southern Mozambique, through Rhodesia to southern and central Angola, apparently breeding on trees of the genus *Julbernardia*. *C. orientale* is restricted to the coastal areas of *Brachystegia* woodland in East Africa. The host plant of *C. orientale* is not known, the species being described from a small series of both sexes trapped in yellow trays at Nachingwea (southern Tanzania), and two males labelled 'Myombo [Swahili for *Brachystegia* woodland] East Africa, 13.iii.1914'. This date would preclude Tanzania so it is thought these are Kenyan specimens probably collected in the coastal woodland somewhere between Mombasa and Malindi. Also in the Nachingwea material there is a male and a female which have the antennal characteristics of *C. orientale* but the male genital structure of *C. julbernardioides*. Furthermore I have examined two male and two females collected on the rift escarpment at Muguga, near Nairobi, which are similarly intermediate.

Clearly the existence of morphologically intermediate specimens must cast doubt on the specific validity of *C. orientale* and it may be argued that these differences are due to the effect of the environment on the phenotype. Whatever the explanation, the observed morphological differences are considered here to have some genetic basis and *C. julbernardioides* and *C. orientale* are regarded as distinct species. The intermediate specimens are not assigned to either taxon.

Ciriacremum africanum Enderlein, 1910 **comb. rev.**

(Text-figs 8, 22, 23, 77, 172–174)

Ciriacremum africanum Enderlein, 1910*b* : 140, figs 2 and B. LECTOTYPE ♂, TANZANIA: 'Kilimandjaro' (NR, Stockholm), here designated [examined].
Bunoparia africana (Enderlein) Enderlein, 1926 : 397.

DESCRIPTION. *Colouration.* Overall body colour mid or dark brown with ochraceous markings; dorsum of head and thorax with strongly developed pattern as in Text-fig. 8; genal cones ochraceous apically and ventrally; fore wing hyaline, vein endings often darkened; legs ochraceous.

Structure. ♂. Small species. Genal cones weakly developed (Text-fig. 8); antennal flagellum relatively short, 1·79–1·95 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·4 : 1·5 : 1·6 : 0·9 : 0·7; ultimate rostral segment relatively long, 1·02–1·43 times longer than third antennal segment and 1·57–2·03 times longer than tenth antennal segment. Fore wing 2·38–2·53 times longer than wide, spinule arrangement as in Text-fig. 77; pterostigma short; *Cu* stem two and a half to two and three-quarters times longer than $M+Cu$ stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 172) with simple basal part and short narrow apical part; paramere (Text-figs 172, 173) strongly compressed, apical two-thirds broader than basal third, on inner surface with an antero-apical tubercle, posterior margin with a compound vertical row of short peg-like setae, postero-basal sensory patch of hairs moderately well developed; distal segment of aedeagus (Text-fig. 174) with narrow apex.

♀. Slightly larger than ♂. Antennal flagellum 1·90–1·95 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·4 : 1·5 : 1·6 : 0·8 : 0·7; ultimate rostral segment 1·00–1·46 times longer than third antennal segment and 1·69–1·91 times longer than tenth antennal segment. Fore wing 2·39–2·56 times longer than wide. Ovipositor short, proctiger 1·32–1·50 times longer than hind tibia.

Measurements (±0·01 mm, based on 10 ♂ and 9 ♀). Maximum width of head, ♂ 0·53–0·64, ♀ 0·52–0·67; length of antennal flagellum, ♂ 0·97–1·20, ♀ 1·05–1·30, length of ultimate rostral segment, ♂ 0·13–0·15, ♀ 0·13–0·16; length of fore wing, ♂ 1·64–1·99, ♀ 1·69–2·24; maximum width of fore wing, ♂ 0·66–0·82, ♀ 0·69–0·94; length of hind tibia, ♂ 0·38–0·46, ♀ 0·37–0·49; length of ♀ proctiger, 0·54–0·67.

HOST PLANT. Among the material examined was a series of adults collected from *Cassia* sp. No further information is available.

MATERIAL EXAMINED.

ZAIRE: 3 ♂, 3 ♀, Elizabethville, x.–xi. 1950, at light; 1 ♂, 2 ♀, 1953–1955, at light; 1 ♀, xi. 1959, at light (*Ch. Seydel*). ANGOLA: 1 ♂, Chianga, 6–7.viii.1963, at light; 12 ♂, 3 ♀, 7–9.ix.1963, at light (*H. Cardosa*); 18 ♂, 31 ♀, 7–9.ix.1966, at light; 9 ♂, 11 ♀, 5–14.ix.1970, yellow trays; 1 ♀, xii. 1970–i. 1971, yellow trays (*A. van Harten*); 22 ♂, 20 ♀, 17.x.1972, at light; 6 ♂, 17 ♀, Ceilunga, 8.x.1972, at light; 4 ♂, Nova Lisboa, 19.viii.1974, at light; 5 ♂, 14 ♀, 19.x.1974 (*J. Passos de Carvalho*); 18 ♂, 22 ♀, 2.ix.1964, on *Cassia* sp. (*E. de Fonseca*). TANZANIA: 1 ♂, 1 ♀, Kilimanjaro (type-series).

DISCUSSION. *C. africanum* and the following species are regarded here as sister species. The form of the male paramere is similar in the two species and quite distinct from others in the genus. In *C. vondraceki* sp. n. (p. 51) the male paramere is similar in shape but the postero-medial sensory patch is composed of short non-articulated denticles, while that of *C. africanum* and *C. megafricanum* sp. n. is composed of peg-like articulated setae.

Ciriacremum megafricanum sp. n.

(Text-figs 19, 22, 23, 48, 78, 175–177)

DESCRIPTION. *Colouration.* Similar to *C. africanum* (p. 48).

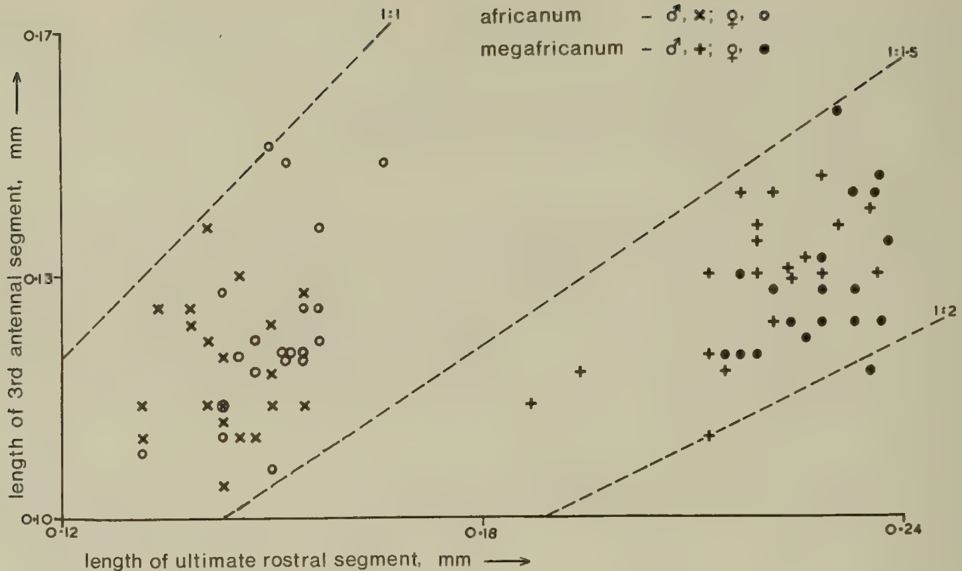
Structure. ♂. Slightly larger than *C. africanum.* Antennal flagellum 1·94–2·14 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·5 : 1·6 : 1·7 : 0·9 : 0·6; ultimate rostral segment much longer than in *C. africanum*, 1·53–2·00 times longer than third antennal segment and 2·19–2·76 times longer than tenth antennal segment. Fore wing 2·41–2·63 times longer than wide, spinule arrangement as in Text-fig. 78. Genitalia similar to *C. africanum* (Text-figs 175–177), inner surface of paramere with slightly better developed group of short cone-like setae postero-medially.

♀. Slightly larger than ♂. Antennal flagellum 1·96–2·10 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·2 : 1·4 : 1·6 : 1·8 : 0·9 : 0·6; ultimate rostral segment 1·51–2·04 times longer than third antennal segment and 2·27–2·94 times longer than tenth antennal segment. Fore wing 2·46–2·67 times longer than wide. Ovipositor (Text-fig. 19) longer than in *C. africanum*, proctiger 1·74–1·95 times longer than hind tibia.

Measurements (±0·01 mm, based on 9 ♂ and 7 ♀). Maximum width of head, ♂ 0·54–0·72, ♀ 0·56–0·69; length of antennal flagellum, ♂ 1·05–1·41, ♀ 1·18–1·45; length of ultimate rostral segment, ♂ 0·19–0·24, ♀ 0·22–0·25; length of fore wing, ♂ 1·64–2·31, ♀ 1·97–2·34; maximum width of fore wing, ♂ 0·63–0·91, ♀ 0·77–0·92; length of hind tibia, ♂ 0·45–0·58, ♀ 0·48–0·58; length of ♀ proctiger, 0·87–1·08.

HOST PLANT. Unknown, all known material collected in traps or as vagrants.

Holotype ♂, ANGOLA: Nova Lisboa, 19.viii.1974 (*J. Passos de Carvalho*) (BMNH, London); slide mounted.



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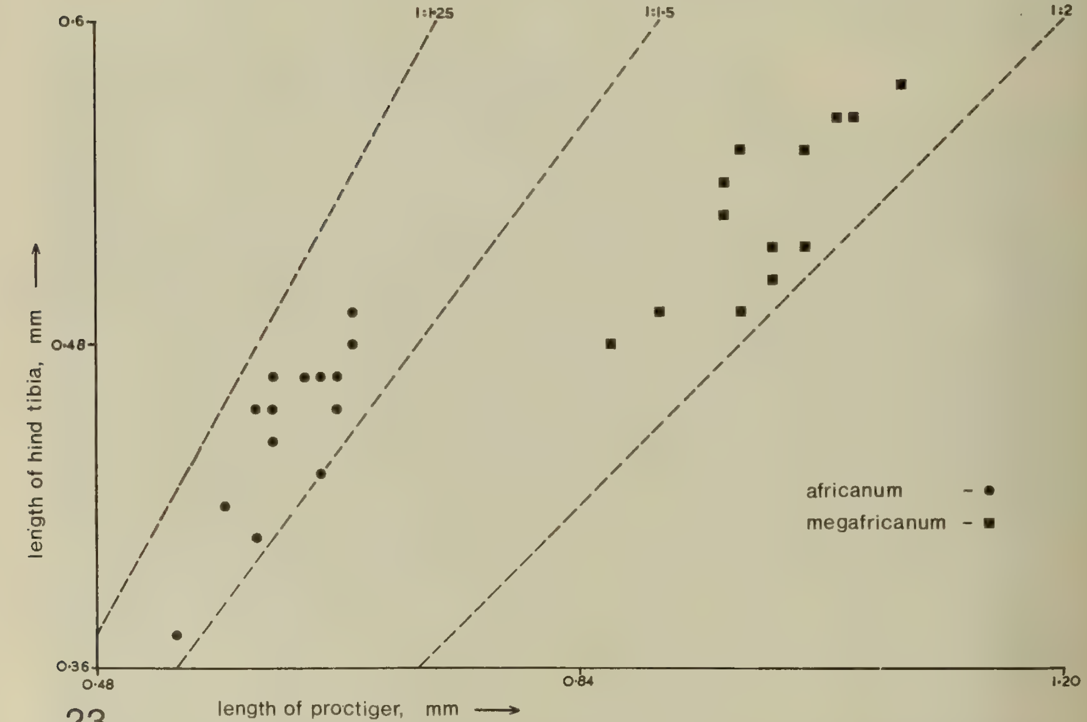

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FIGS 22, 23. Scatter diagrams comparing lengths of various characters of *Ciriacremum africanum* and *C. megafricanum*. 22, length of third antennal segment against length of ultimate rostral segment; 23, length of female hind tibia against length of female proctiger.

Paratypes. ANGOLA: 22 ♂, 32 ♀, same data as holotype; 1 ♂, 2 ♀, Dundo, 4–29.viii.1953, at light (*Luna*); 3 ♂, 2 ♀, Chianga, 2–7.viii.1963, at light; 1 ♂, 2 ♀, 7–9.ix.1963 (*H. Cardosa*); 47 ♂, 62 ♀, 7–9.xi.1966, at light; 24 ♂, 24 ♀, 17.x.1972, at light; 6 ♂, 12 ♀, 26.viii.1974, at light (*J. Passos de Carvalho*); 2 ♂, 1 ♀, 5–14.ix.1970, yellow trays (*A. van Harten*); 1 ♀, Tundavala, 8–10 mls [13–16 km] NW. Sa da Bandeira, 27–29.iii.1972, general sweeping (*BM Southern Africa Expedition*) (BMNH, London; NCI, Pretoria; USNM, Washington); slide mounted and stored in 80% ethanol.

DISCUSSION. *C. megafricanum* is very similar to *C. africanum*. The two species are distinguished from one another by the relative lengths of their ultimate rostral segments (Text-fig. 22) and female proctiger (Text-fig. 23), both structures being much longer in *C. megafricanum*. This would suggest either the two species have different host plants or, if not, then they have different feeding and oviposition sites on a common host. The host plant of *C. africanum* is probably *Cassia* sp. but *C. megafricanum* is only known from trapped and vagrant material. Both species occur together in trap catches.

***Ciriacremum vondraceki* sp. n.**

(Text-figs 49, 79, 178–180)

DESCRIPTION. ♂. Small species. Genal cones poorly developed (Text-fig. 49); antennal flagellum 2·89–3·22 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·3 : 1·4 : 2·0 : 0·6 : 0·4; ultimate rostral segment short, 0·52–0·61 times as long as third antennal segment and 1·46–1·66 times longer than tenth antennal segment. Fore wing 2·43–2·71 times longer than wide, spinule arrangement as in Text-fig. 79; pterostigma short; *Cu* stem about one and three-quarter times longer than *M+Cu* stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 178) with simple basal part and a relatively short narrow apical part; paramere (Text-figs 178, 179) compressed, with short narrow apical part and broad basal part, on inner surface with a well developed apical tooth and a postero-medial group of large non-articulated denticles, postero-basal setae not at all developed; distal segment of aedeagus (Text-fig. 180) with broad apex and an extraordinary long terminal tube; hypovalves (Text-fig. 178) moderately long and broad.

♀. Slightly larger than ♂. Antennal flagellum 3·05–3·11 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 0·9 : 1·0 : 1·4 : 1·5 : 1·9 : 0·6 : 0·3; ultimate rostral segment 0·58–0·62 times as long as third antennal segment and 1·73–1·76 times longer than tenth antennal segment. Fore wing 2·47–2·52 times longer than wide. Ovipositor relatively short, proctiger 1·04–1·09 times longer than hind tibia.

Measurements (±0·01 mm, based on 3 ♂ and 2 ♀). Maximum width of head, ♂ 0·63–0·65, ♀ 0·71; length of antennal flagellum, ♂ 1·81–2·08, ♀ 2·16–2·20; length of ultimate rostral segment, ♂ 0·13–0·14, ♀ 0·15; length of fore wing, ♂ 1·91–2·16, ♀ 2·39–2·46; maximum width of fore wing, ♂ 0·73–0·89, ♀ 0·95–1·00; length of hind tibia, ♂ 0·47–0·48, ♀ 0·52–0·53; length of ♀ proctiger, 0·56–0·57.

HOST PLANT. Unknown, the type-series was collected at light.

Holotype ♂, ANGOLA: Dundo, ii.–iii. 1954, at light (*Luna*) (BMNH, London); slide mounted.

Paratypes. ANGOLA: 2 ♂, 2 ♀, same data and depository as holotype; slide mounted.

DISCUSSION. *C. vondraceki* sp. n. is superficially similar to *C. africanum* but may be distinguished by its relatively longer antennae and the form of the male genitalia. The male paramere is very unusual in that on the postero-medial inner surface there is a large patch of apparently non-articulated denticles. Normally this area bears strongly developed articulated setae. Also in *C. vondraceki* the terminal tube of the aedeagus is very large.

In the BMNH collections there are several specimens of both sexes from various localities in Central and West Africa which are similar to the type-series of *C. vondraceki* but show clear differences in the structure of the distal segment of the aedeagus (Text-figs 181, 182), wing venation and spinule arrangement. In the male specimens the aedeagus bears a large terminal tube, very similar to *C. vondraceki*, but different from one another in each case. Furthermore the male parameres are similarly adorned with non-articulated spinules on the inner postero-medial surface as in *C. vondraceki*. I suspect that these forms, together with *C. vondraceki*, form a complex of closely related species but inadequate material precludes further description at present.

***Ciriacremum jilorense* sp. n.**

(Text-figs 50, 80, 135–137)

DESCRIPTION. *Colouration.* Overall body colour from green to mid brown with ochraceous markings; pattern on dorsum of head and thorax similar to *C. bicaudatum* (Text-fig. 7); genal cones ochraceous apically and dark brown or black ventrally; pleurae ochraceous or light brown; fore wing hyaline with a dark brown spot proximal to point where claval suture meets hind margin; legs mainly ochraceous, femora dark brown medially; abdomen dark along dorsal mid line, pale laterally and ventrally.

Structure. ♂. Small species. Genal cones moderately well developed (Text-fig. 50); antennal flagellum relatively short, 2·35–2·51 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·4 : 1·6 : 1·8 : 0·7 : 0·5; ultimate rostral segment short, 0·55–0·70 times as long as third antennal segment and 1·26–1·45 times longer than tenth antennal segment. Fore wing 2·26–2·44 times longer than wide, spinule arrangement as in Text-fig. 80; pterostigma short; *Cu* stem two to two and a half times longer than *M*+*Cu* stem; first cubital cell about one and a half times longer than wide. Proctiger (Text-fig. 135) with simple, relatively narrow basal part, and short narrow apical part; paramere (Text-figs 135, 136) relatively large, compressed, on inner surface in apical half with a vertical ridge on anterior margin, and a compound row of differentiated setae on posterior margin, a well developed tubercle medially and with a poorly developed postero-basal sensory patch of setae; distal segment of aedeagus (Text-fig. 137) with narrow apex; hypovalves (Text-fig. 135) short, narrow.

♀. Slightly larger than ♂. Antennal flagellum 2·19–2·27 times longer than width of head, relative lengths of flagellar segments from base to apex – 1·0 : 1·0 : 1·1 : 1·3 : 1·5 : 1·7 : 0·7 : 0·5; ultimate rostral segment 0·63–0·70 times as long as third antennal segment and 1·32–1·44 times longer than tenth antennal segment. Fore wing 2·22–2·46 times longer than wide. Ovipositor of moderate length, proctiger 1·55–1·81 times longer than hind tibia.

Measurements (±0·01 mm, based on 7 ♂ and 5 ♀). Maximum width of head, ♂ 0·61–0·74, ♀ 0·68–0·79; length of antennal flagellum, ♂ 1·51–1·83, ♀ 1·49–1·76; length of ultimate rostral segment, ♂ 0·11–0·12, ♀ 0·12–0·13; length of fore wing, ♂ 1·73–2·00, ♀ 2·00–2·31; maximum width of fore wing, ♂ 0·71–0·88, ♀ 0·82–1·05; length of hind tibia, ♂ 0·43–0·50, ♀ 0·45–0·54; length of ♀ proctiger, 0·75–0·85.

Host plant. The type-series was collected from several specimens of *Cynometra webberi* Baker in the Kenya coastal *Brachystegia* woodland; no larvae were found.

Holotype ♂, Kenya: Arabuku-Sokoke Forest, Jilore track, 2–3.vii.1974, from *Cynometra webberi* (*David Hollis*) (BMNH, London); dry mounted.

Paratypes. Kenya: 9 ♂, 14 ♀, same data as holotype (BMNH, London; NM, Nairobi); slide and dry mounted.

Discussion. *C. jilorense* sp. n. is difficult to relate to other species in the genus, having quite distinctive male genitalia. The relatively simple paramere is similar to the primitive type found in *Kleiniella* species and it may be that *C. jilorensis* is an early offshoot of the main *Ciriacremum* stock. Chorological and host plant evidence would also suggest this species has been isolated from the bulk of the Central African species for some considerable time.

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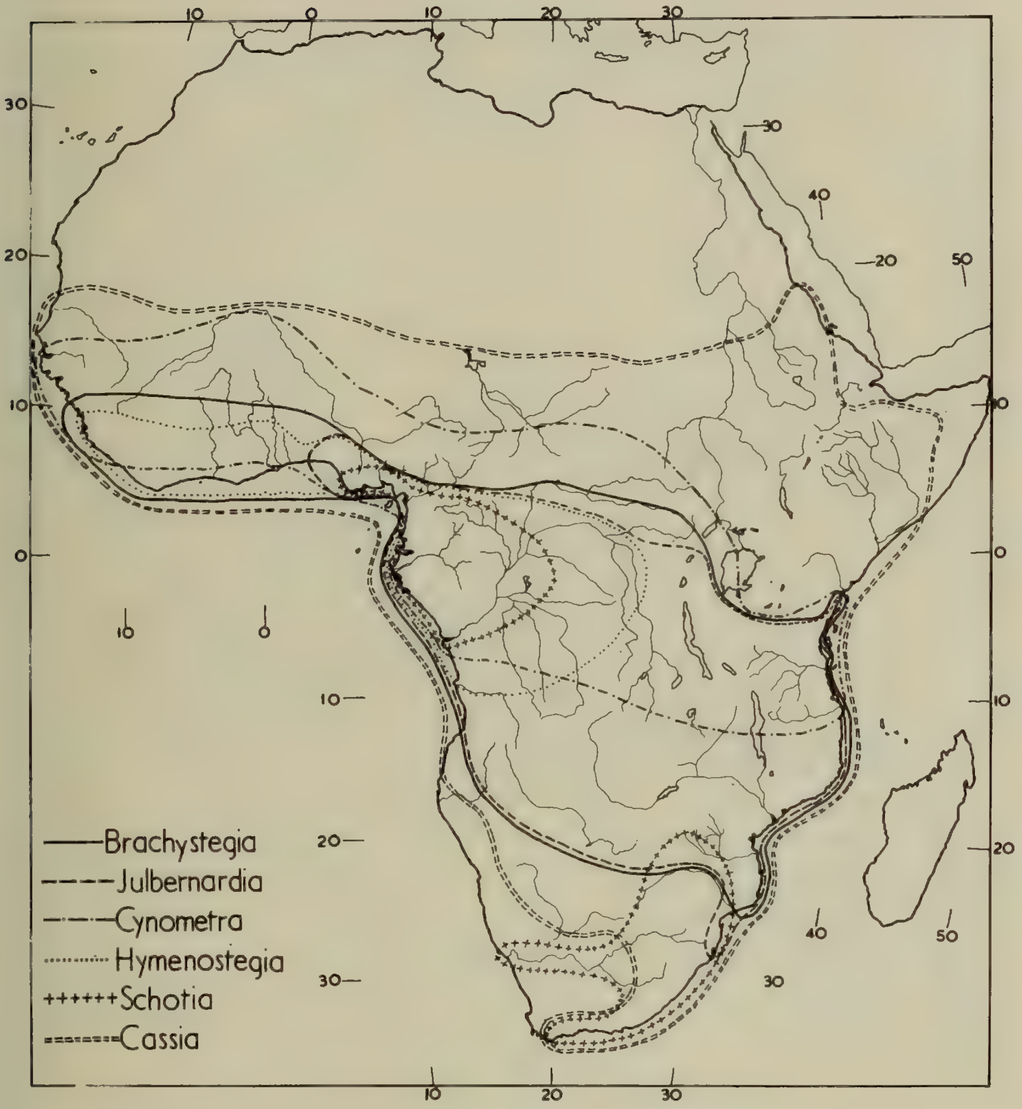
——Brachystegia
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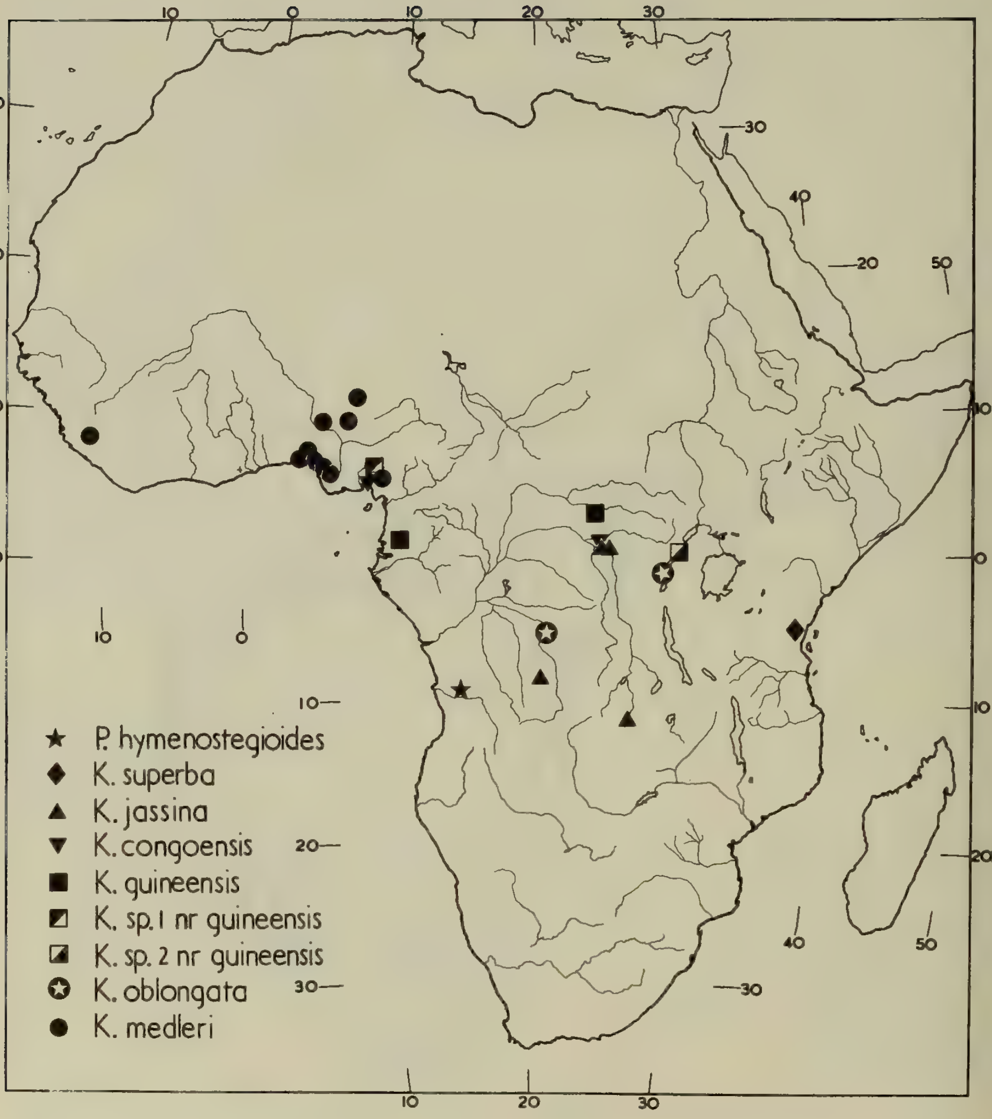
Map 1. Estimated distribution limits in Ethiopian region of six genera of Caesalpiniaceae recorded as hosts of Ciriacremini.


★ P. hymenostegioides
◆ K. superba
▲ K. jassina
▼ K. congoensis
■ K. guineensis
◩ K. sp. 1 nr guineensis
◪ K. sp. 2 nr guineensis
✪ K. oblongata
● K. medleri
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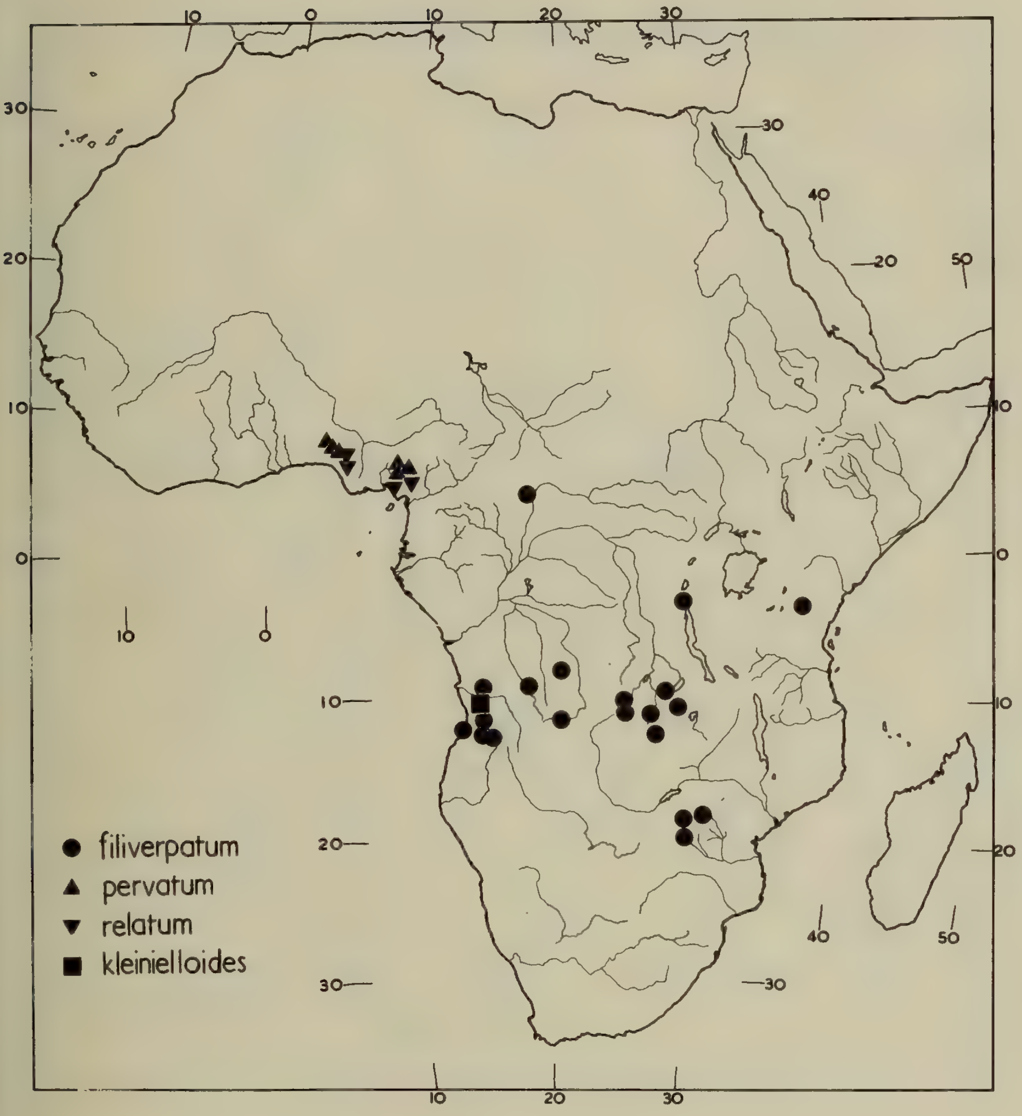
MAP 2. Distribution of *Palmapenna hymenostegioides* and *Kleiniella* species.



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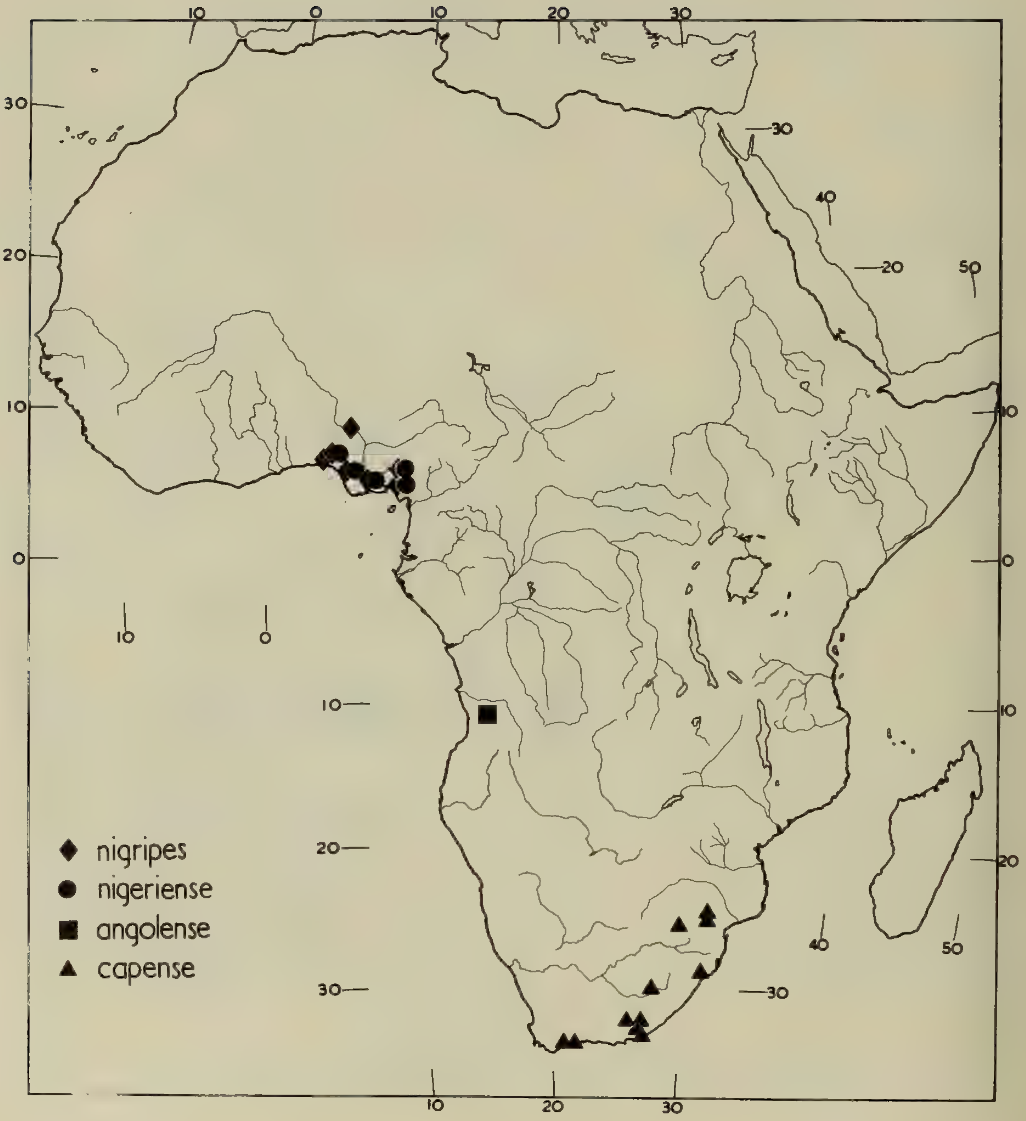
● filiverpatum
▲ pervatum
▼ relatum
■ kleinielloides

MAP 3. Distribution of *Ciriacremum* species, *filiverpatum*-group.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▲ capense
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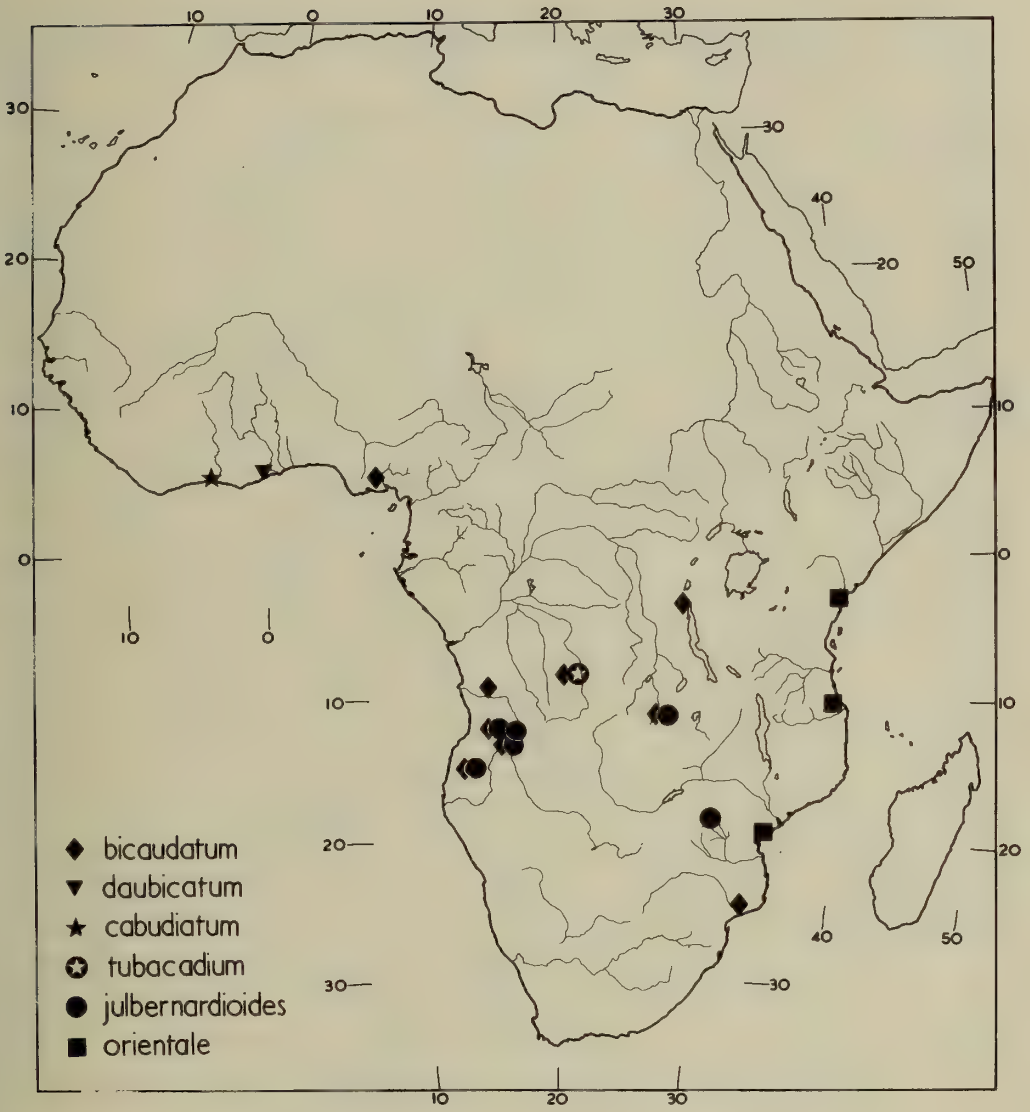
Map 4. Distribution of *Ciriacremum* species.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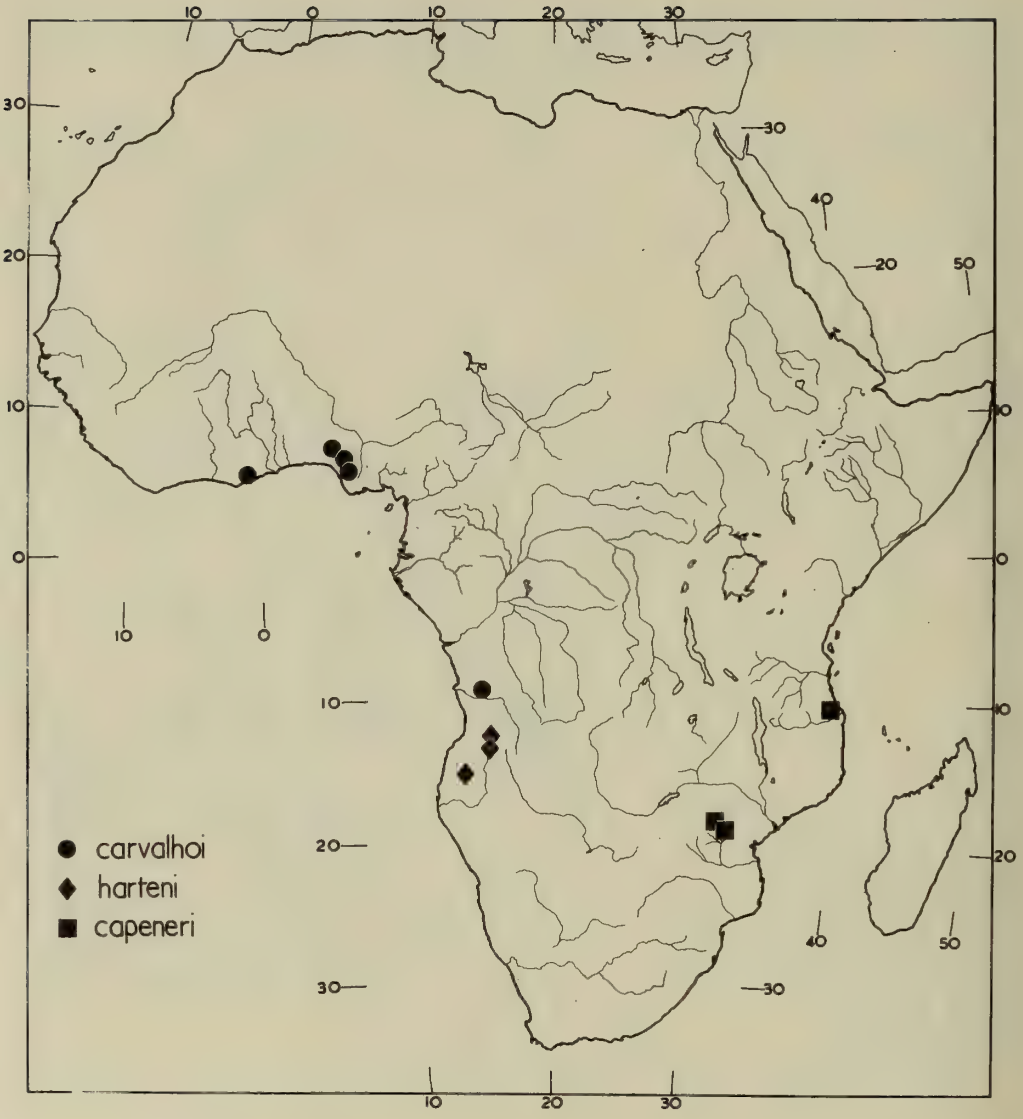
◆ bicaudatum
▼ daubicatum
★ cabudiatum
✪ tubacadium
● julbernardioides
■ orientale

Map 5. Distribution of *Ciriacremum* species, *bicaudatum*-group, part.



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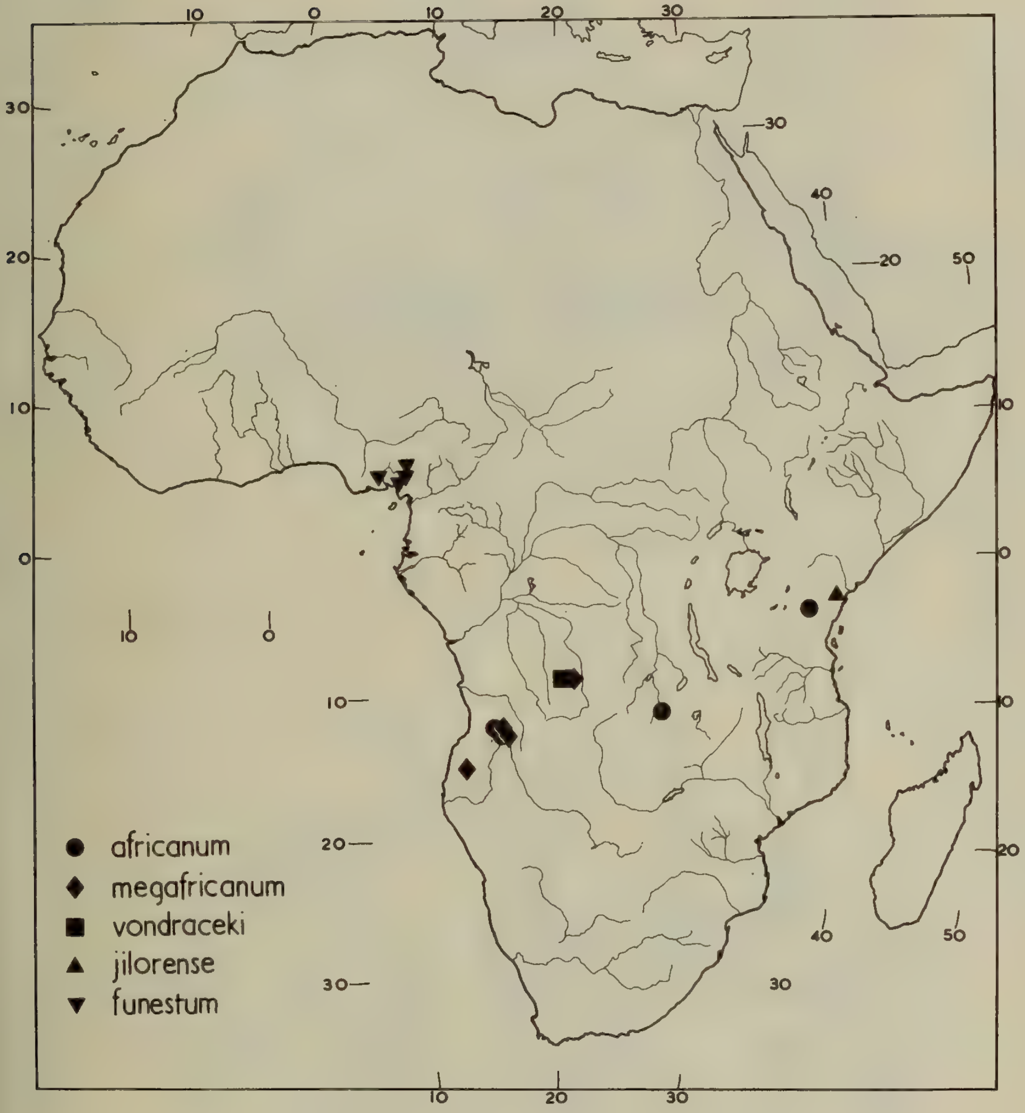
● carvalhoi
◆ harteni
■ capeneri

Map 6. Distribution of *Ciriacremum* species, *bicaudatum*-group, part.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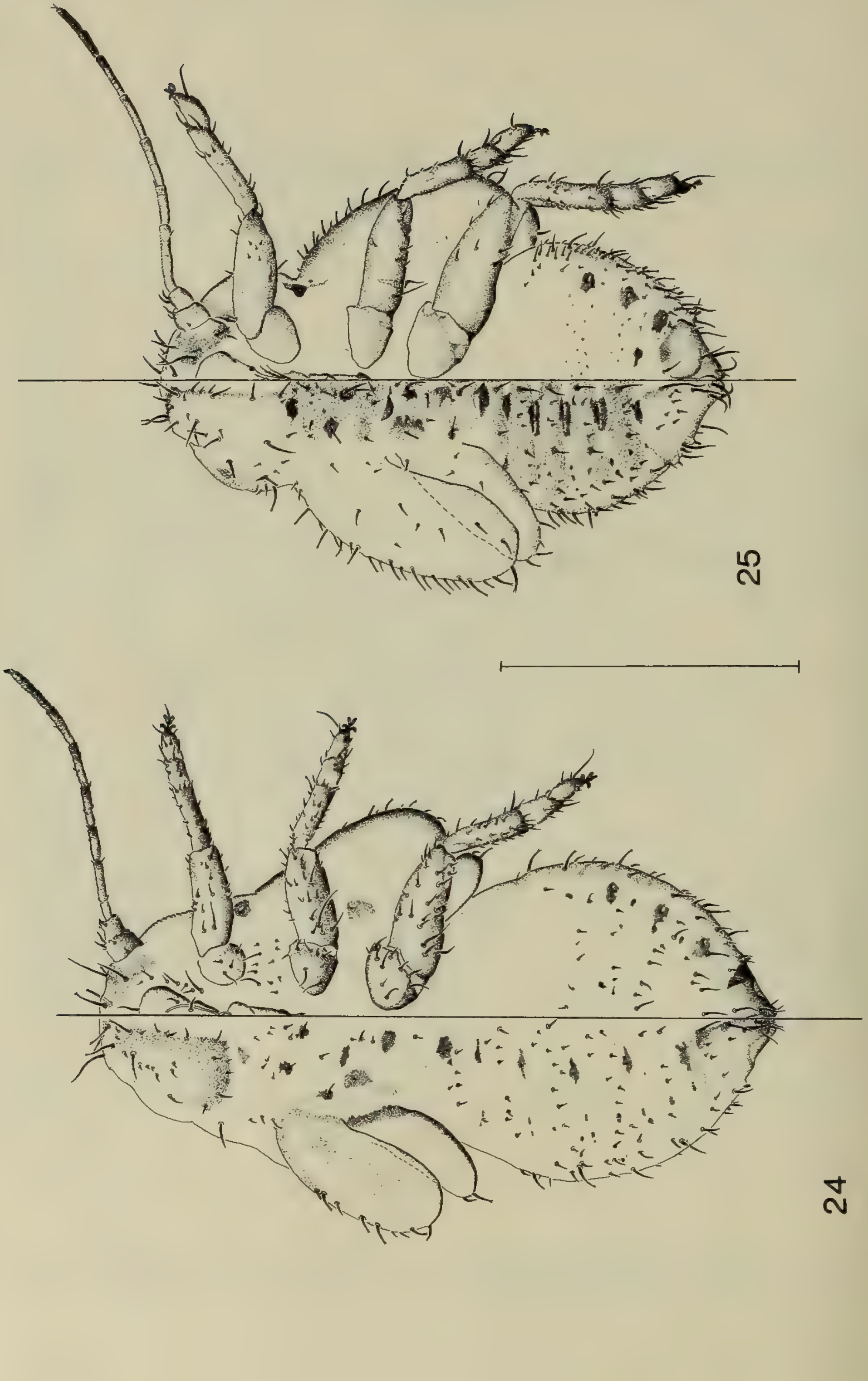
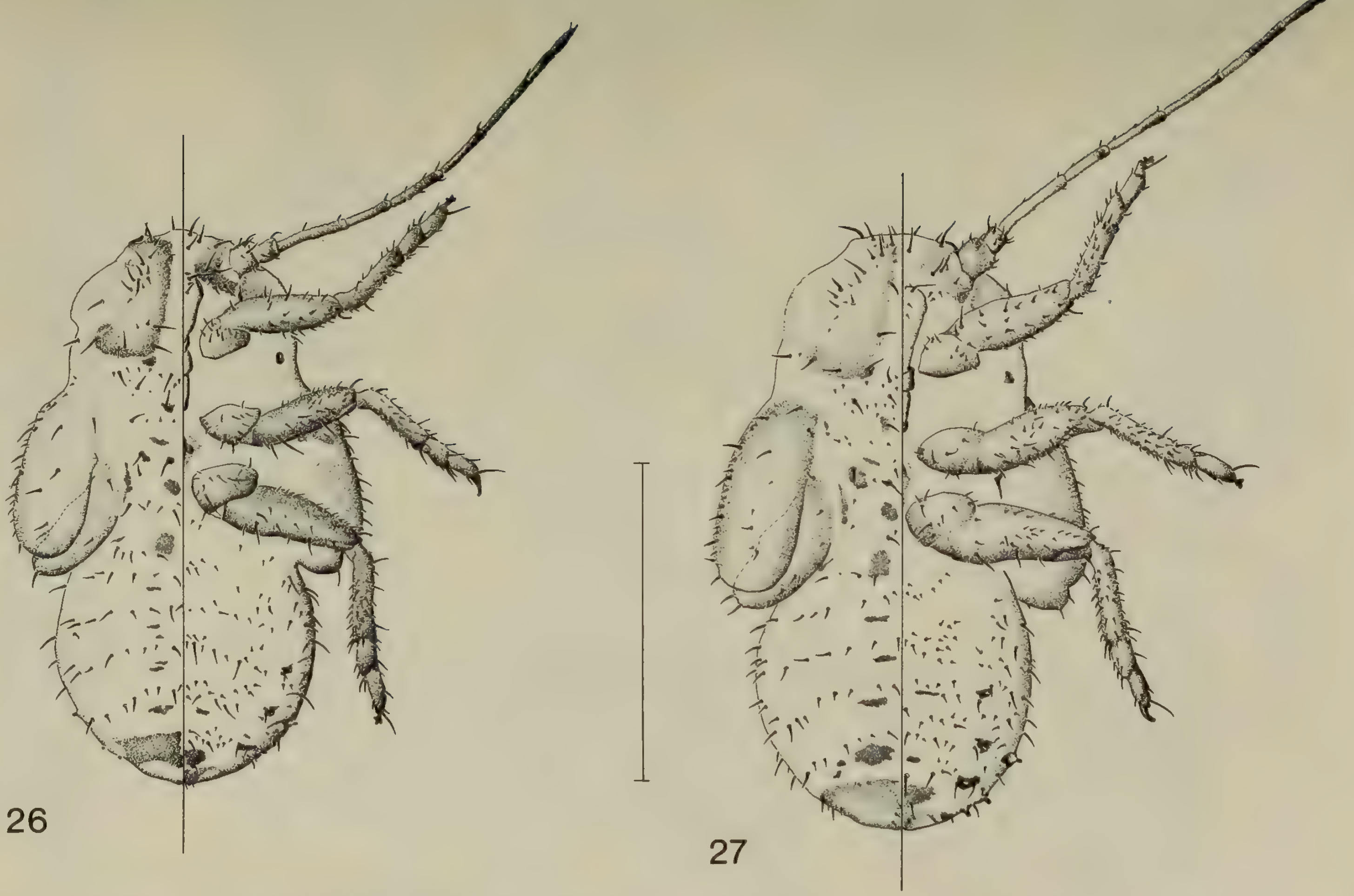
● africanum
◆ megafricanum
■ vondraceki
▲ jilorense
▼ funestum

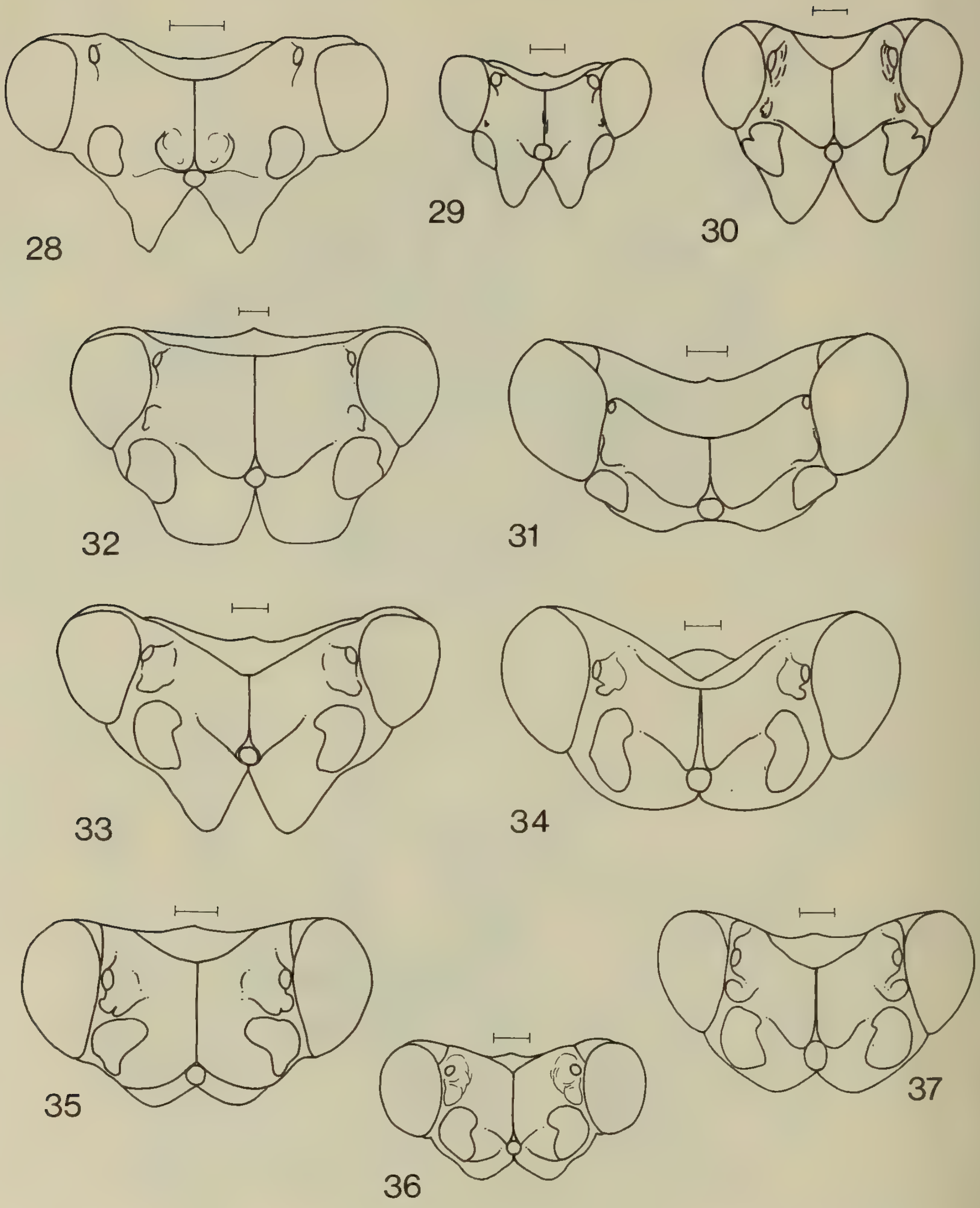
MAP 7. Distribution of *Ciriacremum* species.



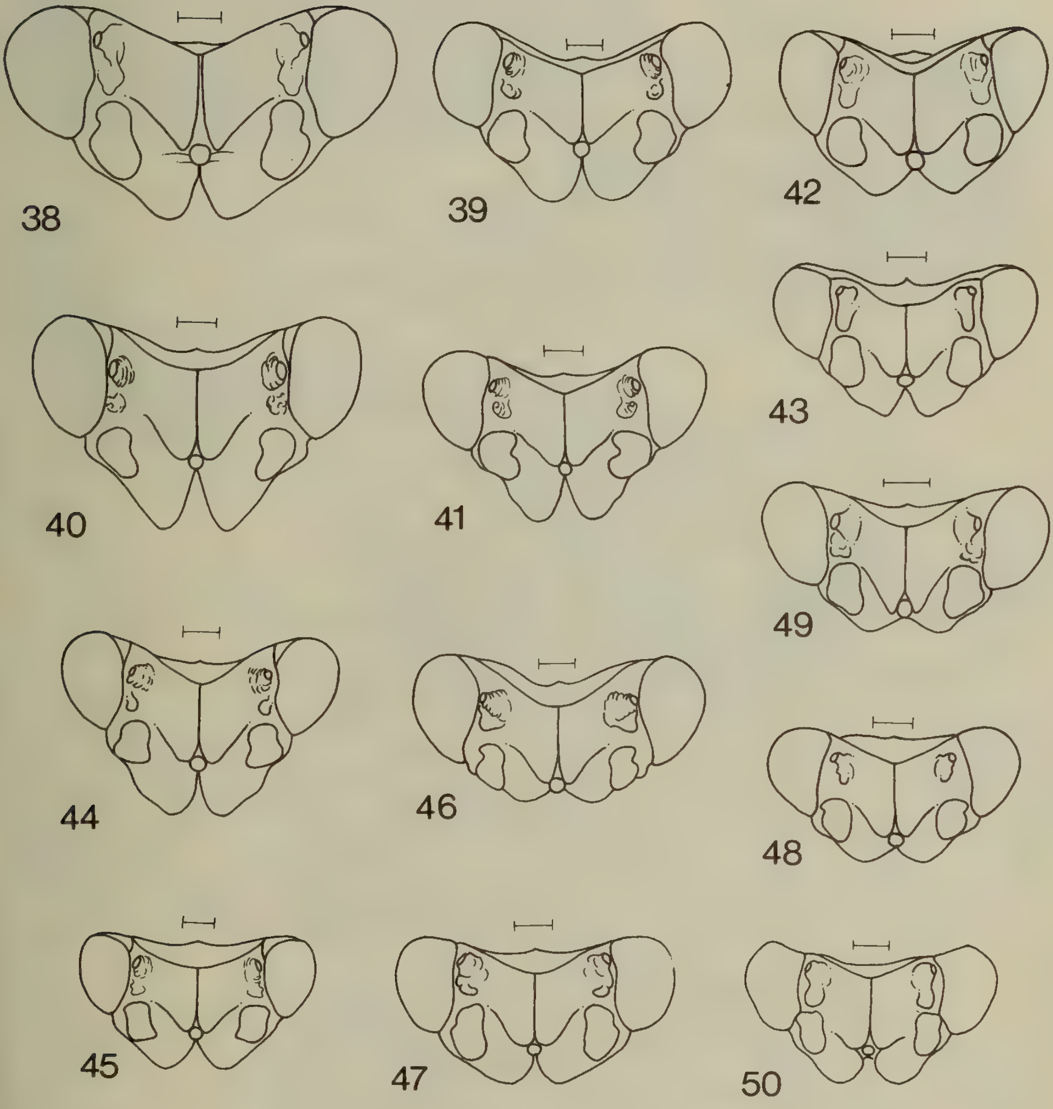
FIGS 24, 25. *Ciriacremum* species, late instar larvae. 24, *C. harteni*; 25, *C. julbernardioides*. Scale line represents 1·0 mm.



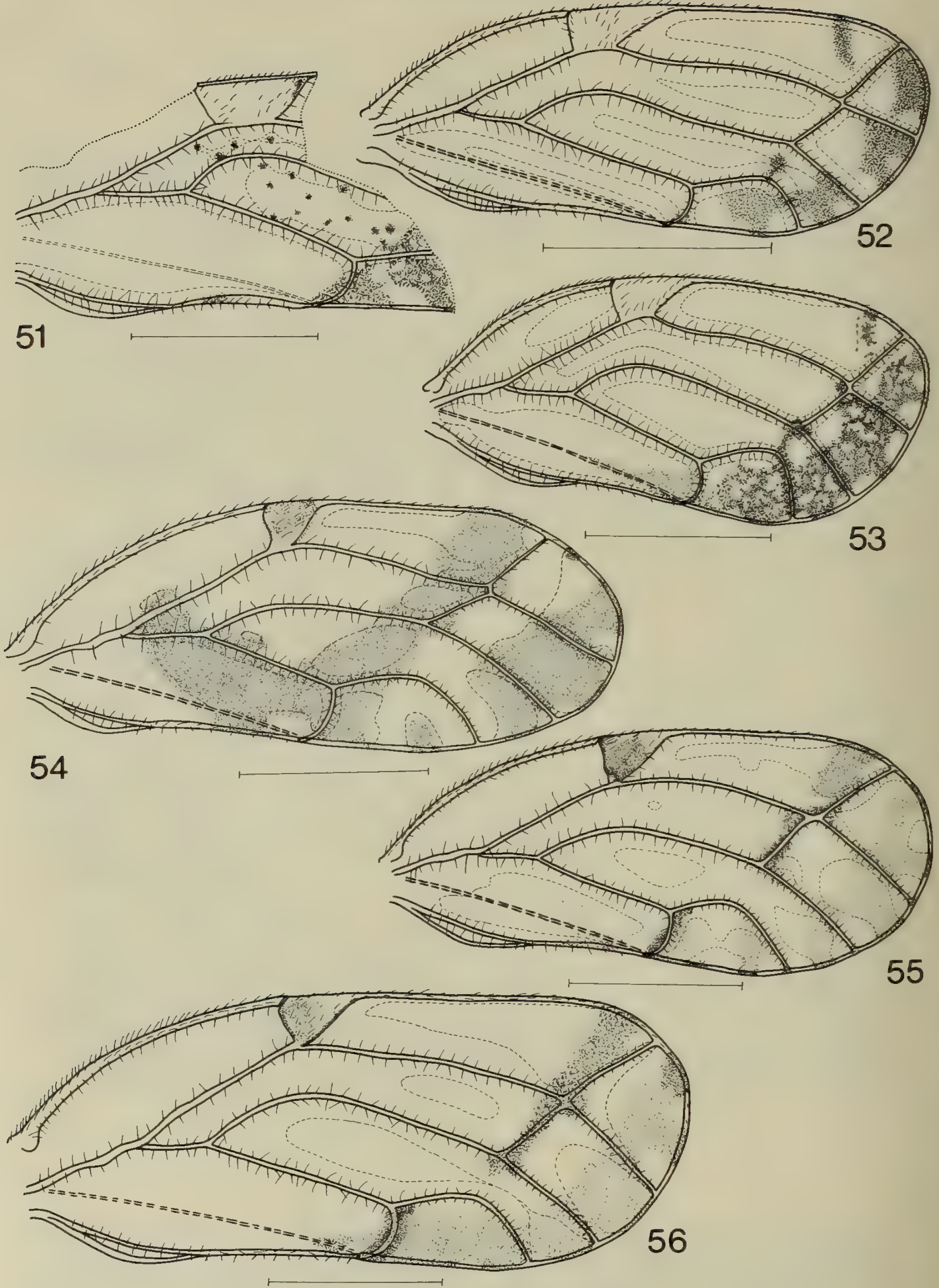
FIGS 26, 27. *Ciriacremum* species, late instar larvae. 26, *C. capense*; 27, *C. capeneri*. Scale line represents 1·0 mm.



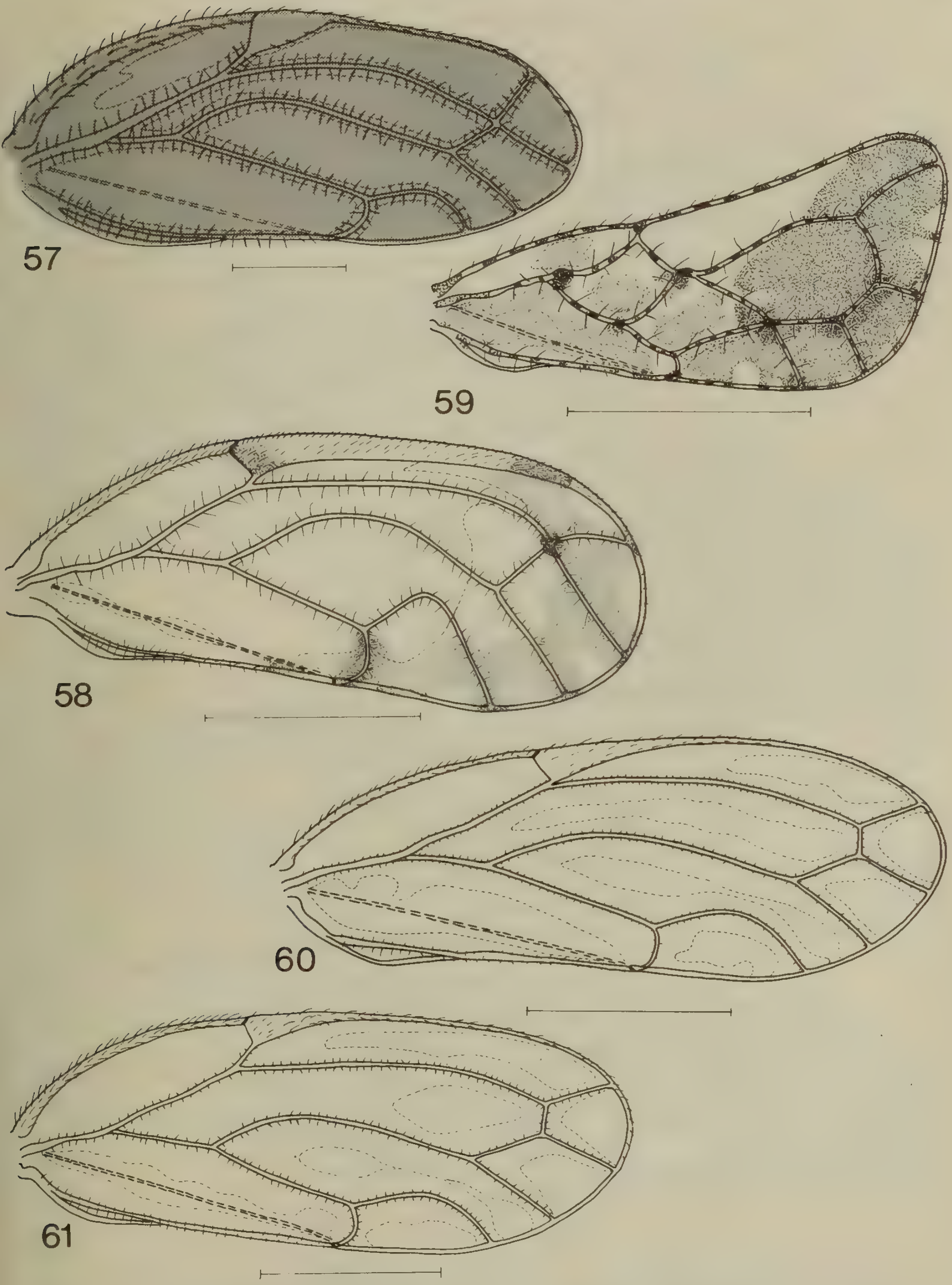
FIGS 28–37. Ciriacremini species; head, dorsal view. 28, *Panisopelma* (*Connectopelma*) *conifrons*; 29, *Palmapenna hymenostegioides*; 30, *Kleiniella guineensis*; 31, *K. jassina*; 32, *K. oblongata*; 33, *K. medleri*; 34, *Ciriacremum filiverpatum*; 35, *C. nigripes*; 36, *C. nigeriense*; 37, *C. angolense*. Scale line represents 0·1 mm.



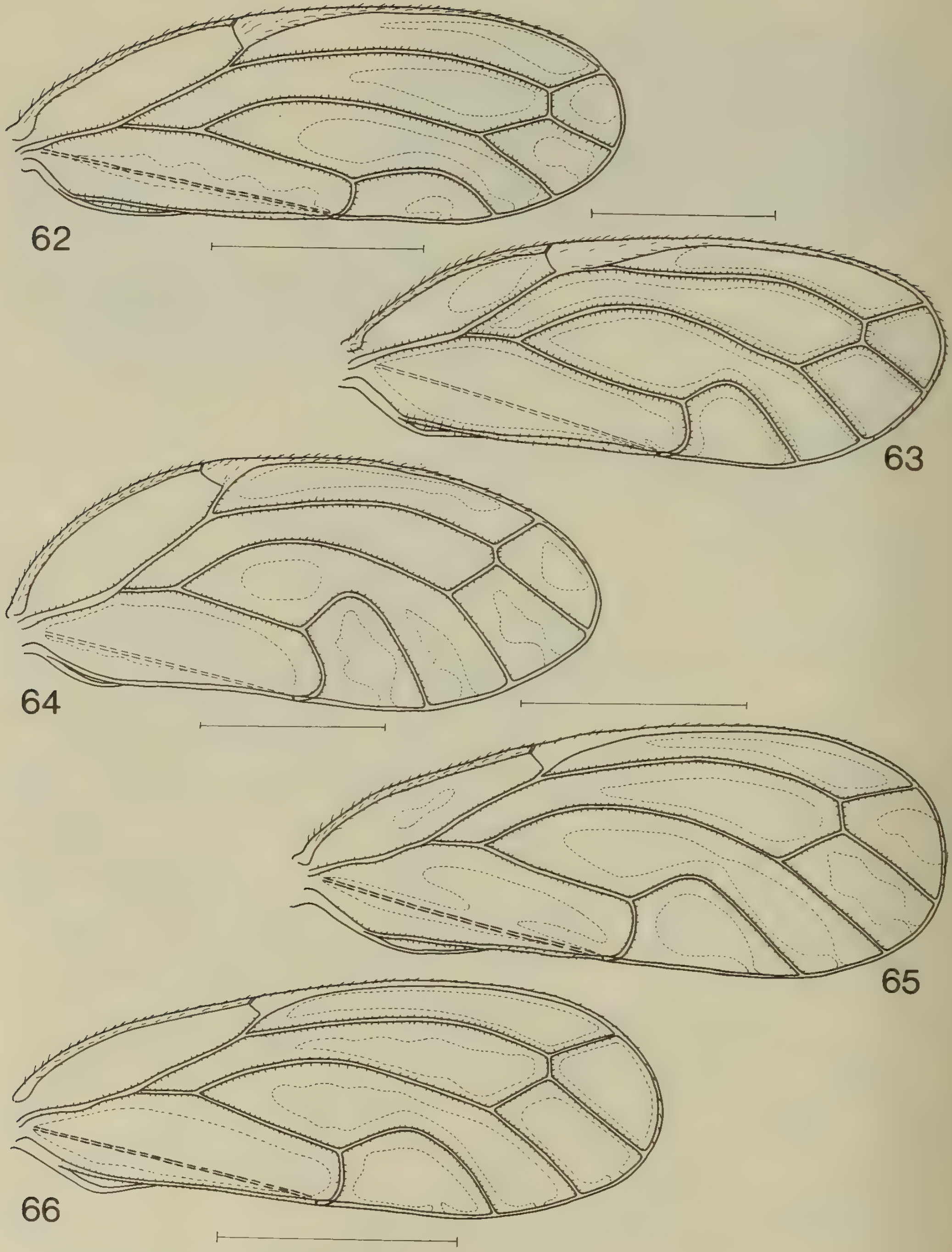
FIGS 38–50. *Ciriacremum* species; head, dorsal view. 38, *C. bicaudatum*; 39, *C. daubicatum*; 40, *C. cabudiatum*; 41, *C. tubacadium*; 42, *C. harteni*; 43, *C. capeneri*; 44; *C. carvalhoi*; 45, *C. julbernardioides*; 46, *C. funestum*; 47, *C. capense*; 48, *C. megafricanum*; 49, *C. vondraceki*; 50, *C. jilorense*. Scale line represents 0·1 mm.



Figs 51–56. *Kleiniella* species, fore wings. 51, *K. superba*; 52, *K. jassina*; 53, *K. congoensis*; 54, *K. guineensis*; 55, *Kleiniella* species 1 near *guineensis*; 56, *Kleiniella* species 2 near *guineensis*. Scale line represents 1·0 mm.



FIGS 57–61. Ciriacremini species, fore wings. 57, *Kleiniella oblongata*; 58, *K. medleri*; 59, *Palmapenna hymenostegioides*; 60, *Ciriacremum filiverpatum*; 61, *C. velatum*. Scale line represents 1·0 mm.



Figs 62–66. *Ciriacremum* species, fore wings. 62, *C. pervatum*; 63, *C. kleinielloides*; 64, *C. angolense*; 65, *C. nigripes*; 66, *C. nigeriense*. Scale line represents 1·0 mm.
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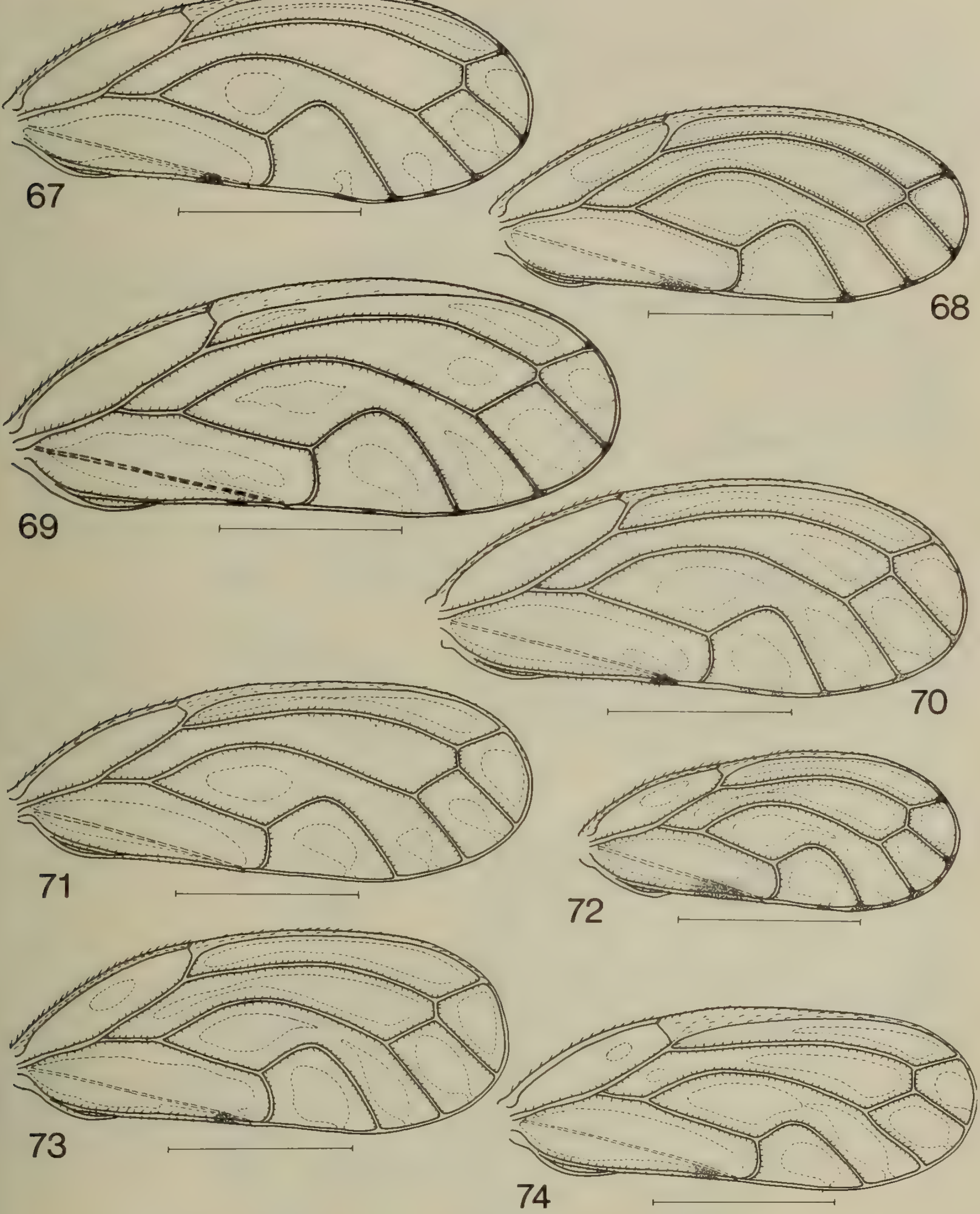
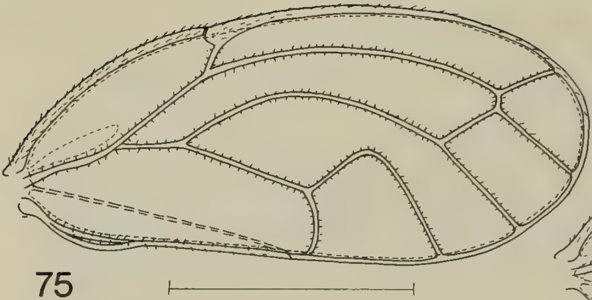


Figs 67–74. *Ciriacremum* species, fore wings. 67, *C. bicaudatum*, from Angola; 68, same, from Nigeria; 69, *C. daubicatum*; 70, *C. cabudiatum*; 71, *C. tubacadium*; 72, *C. harteni*; 73, *C. carvalhoi*; 74, *C. capeneri*. Scale line represents 1·0 mm.



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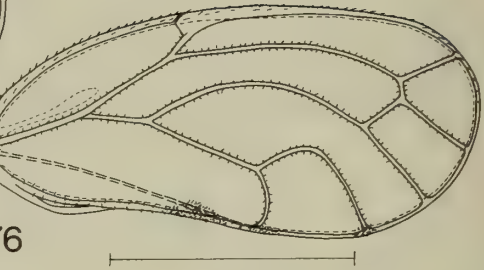

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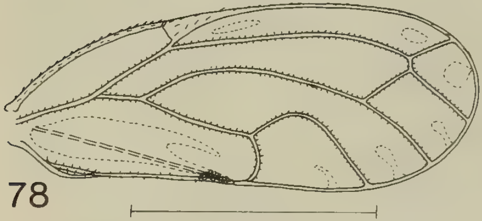

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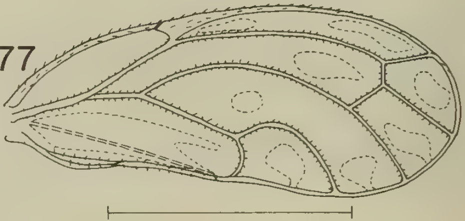

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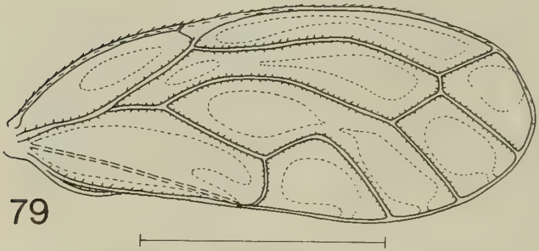

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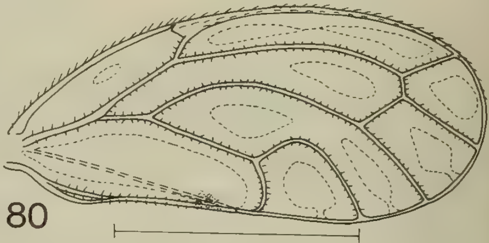

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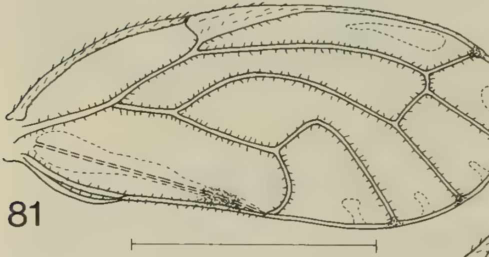

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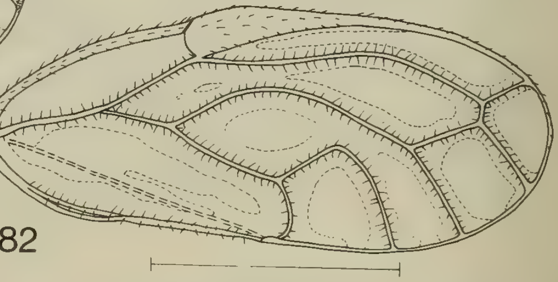

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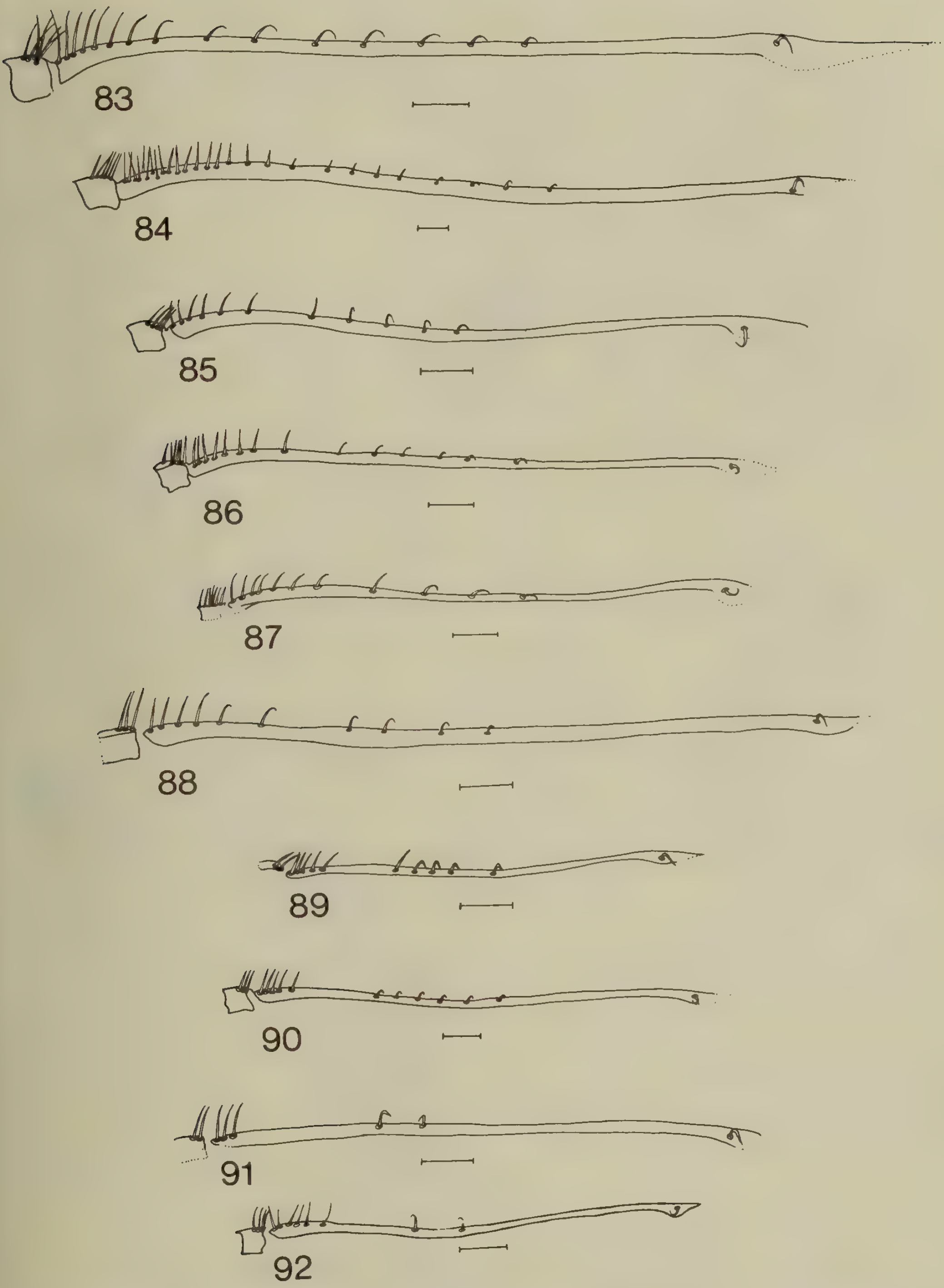

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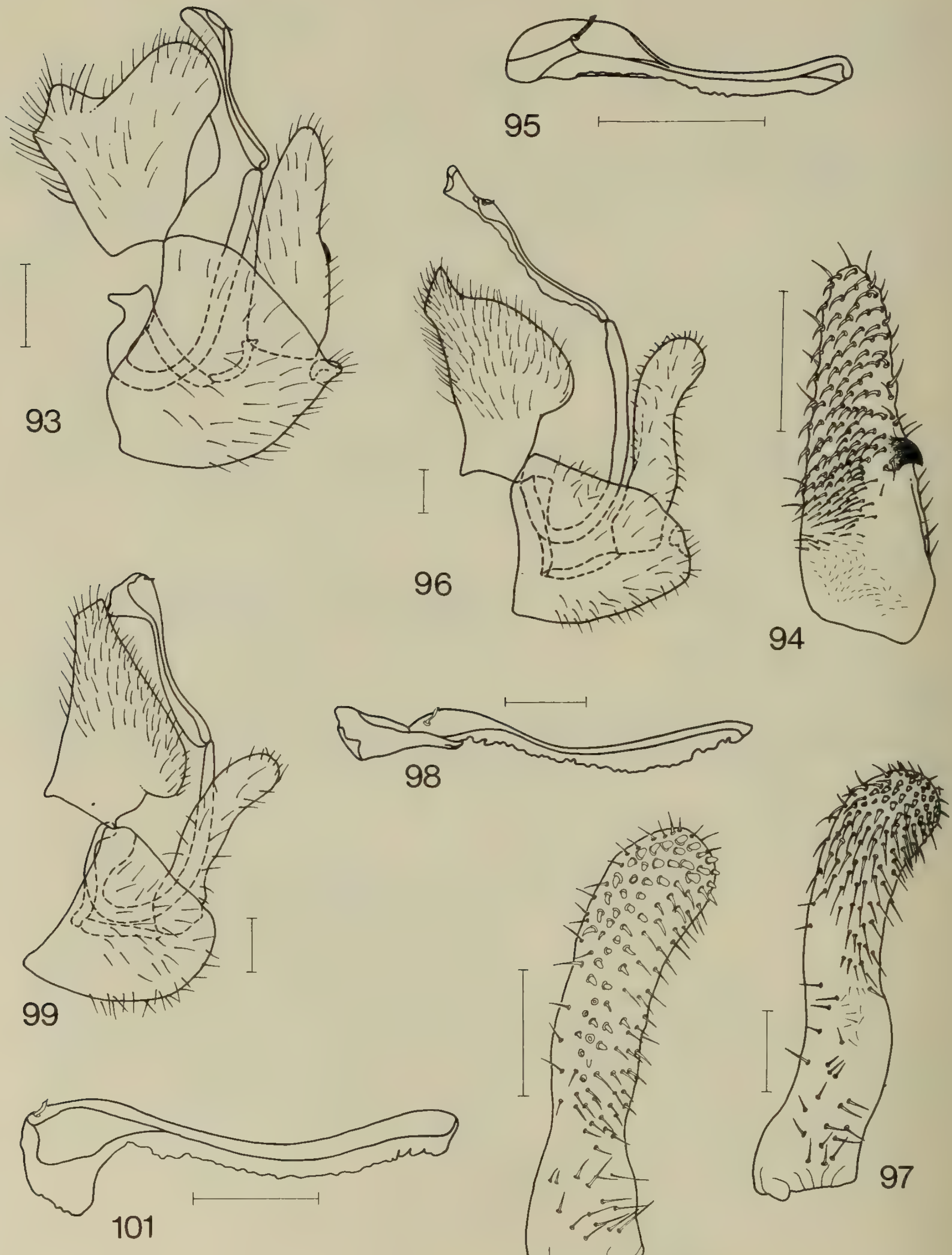

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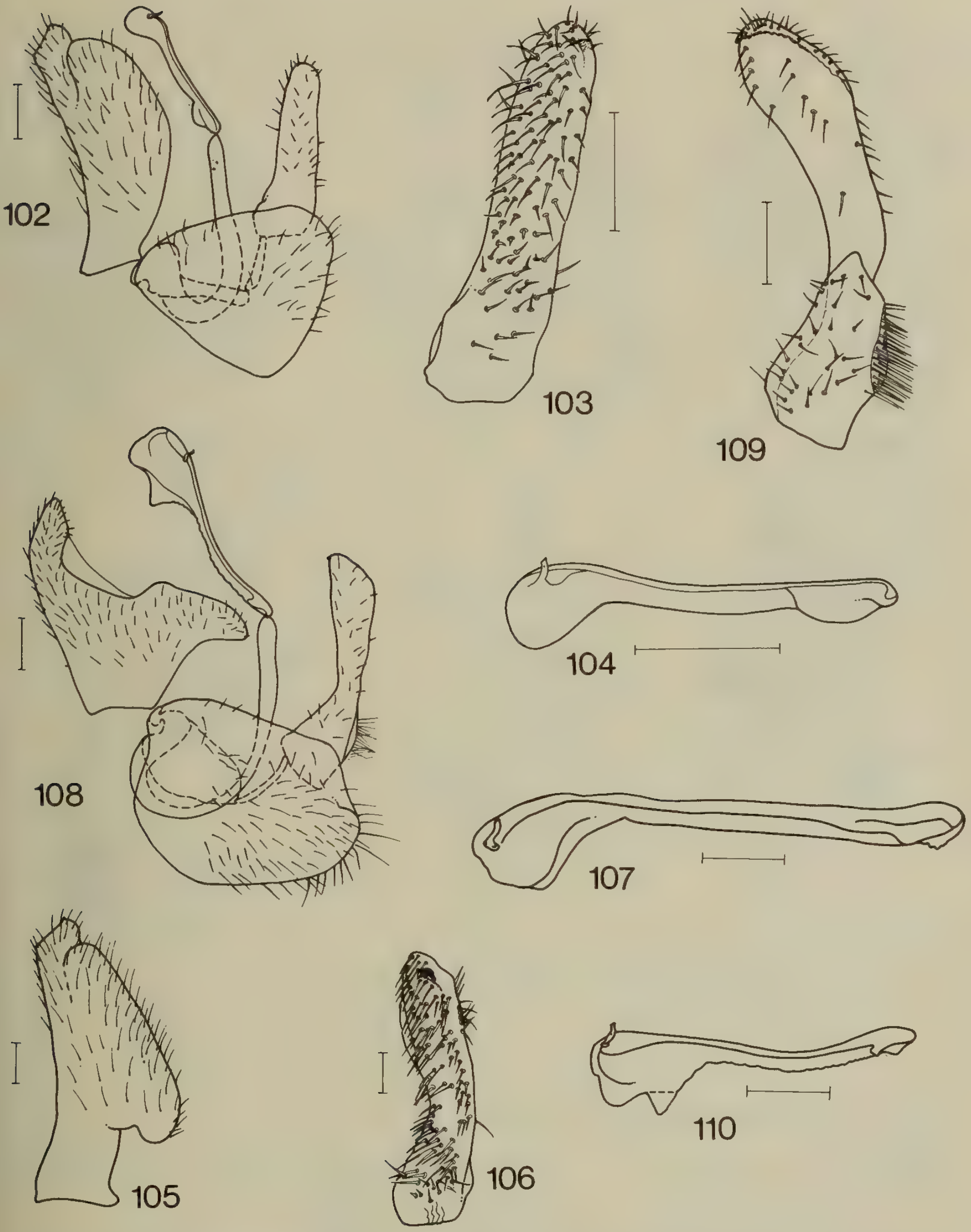

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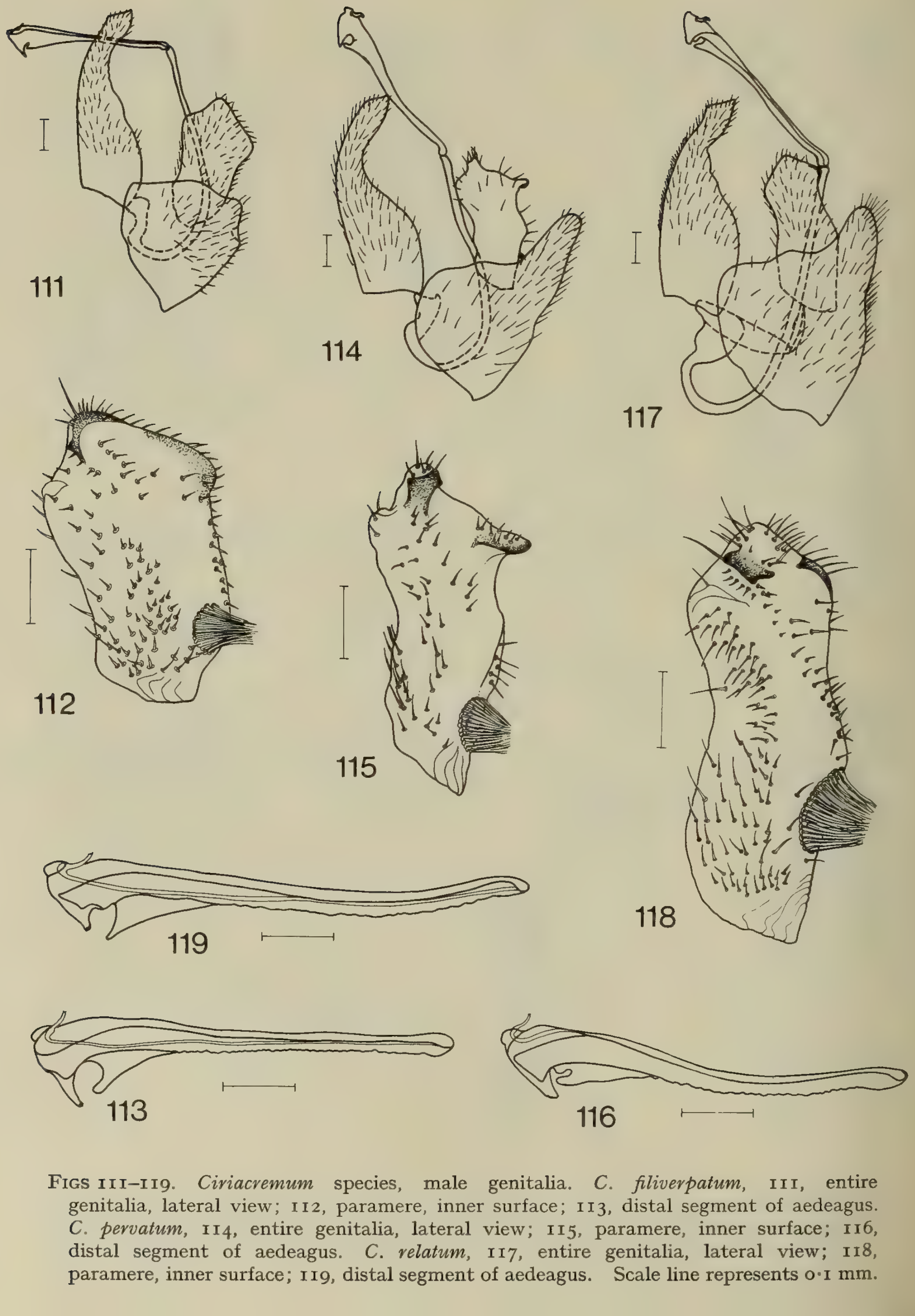

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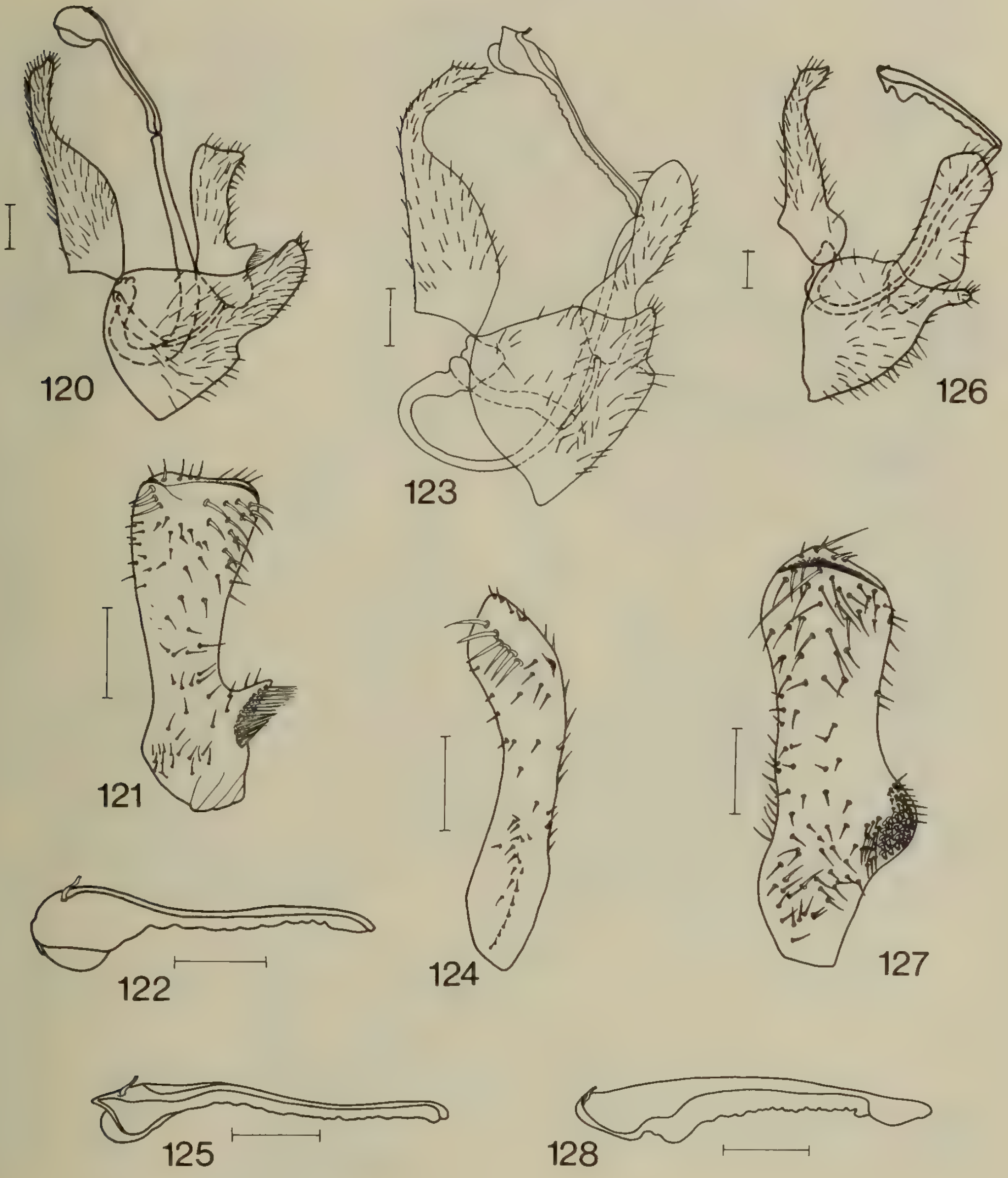

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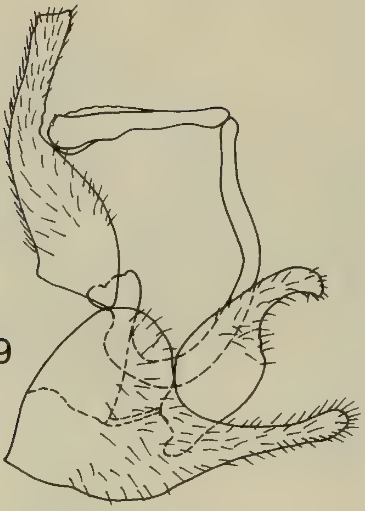

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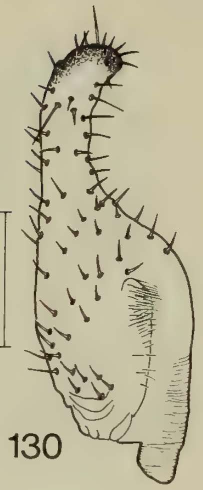

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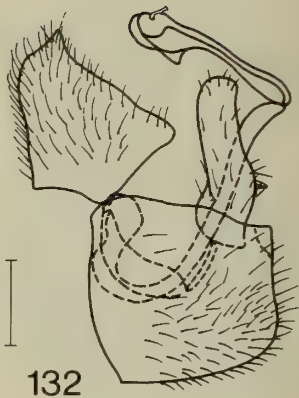

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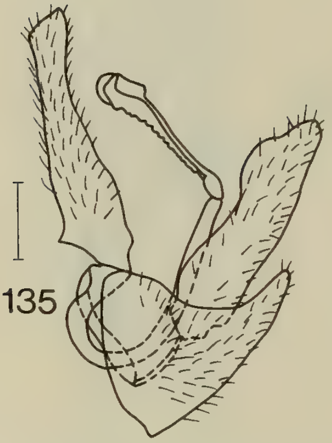

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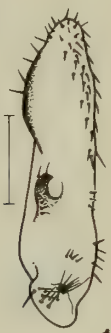

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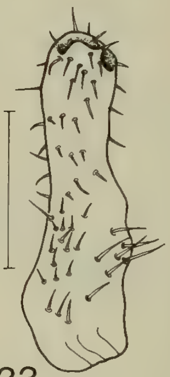

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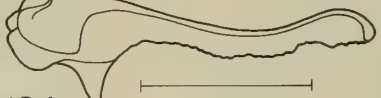

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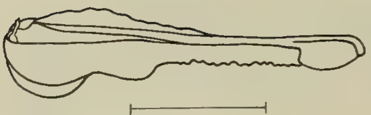

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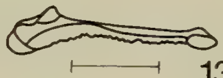

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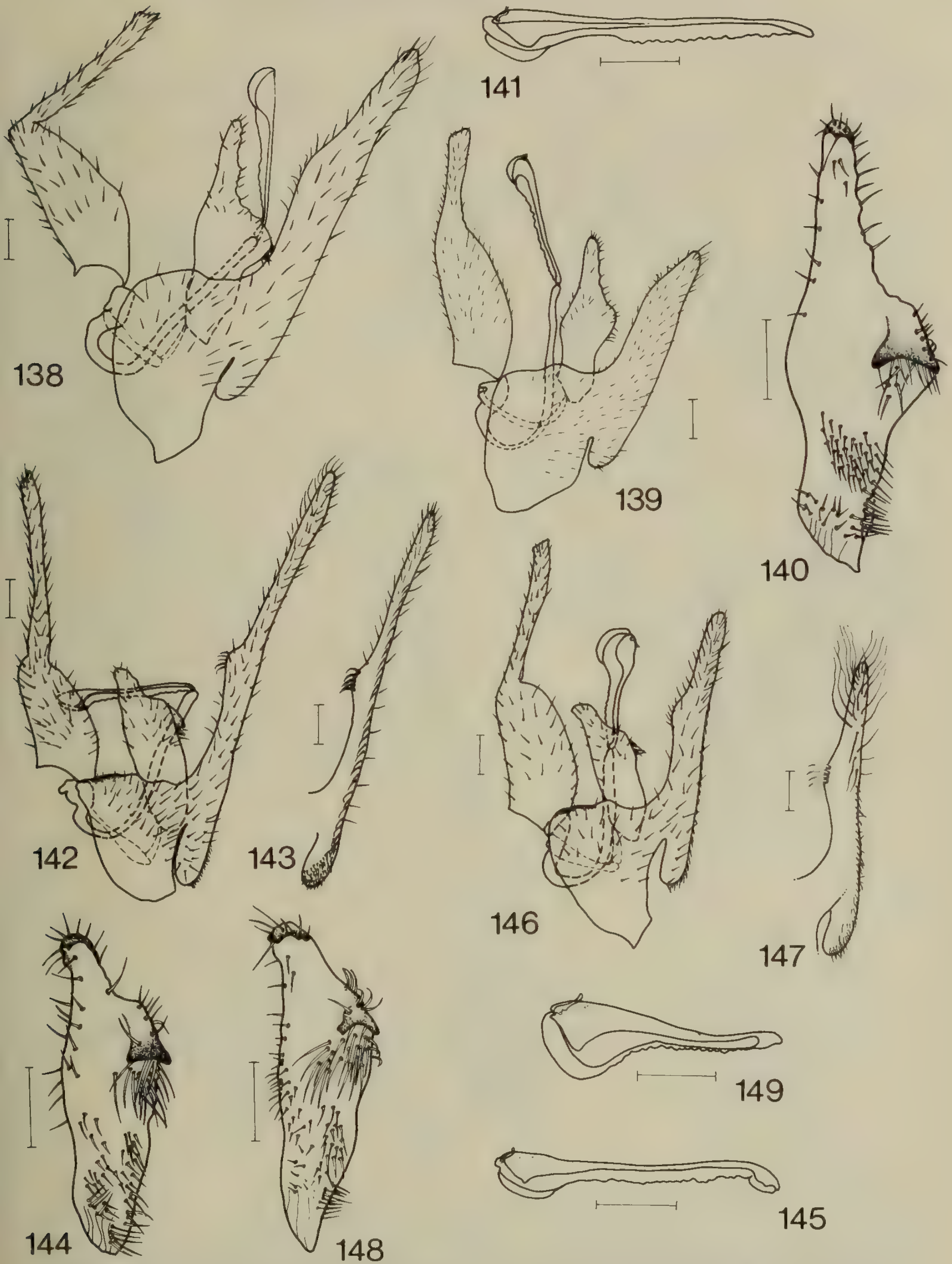

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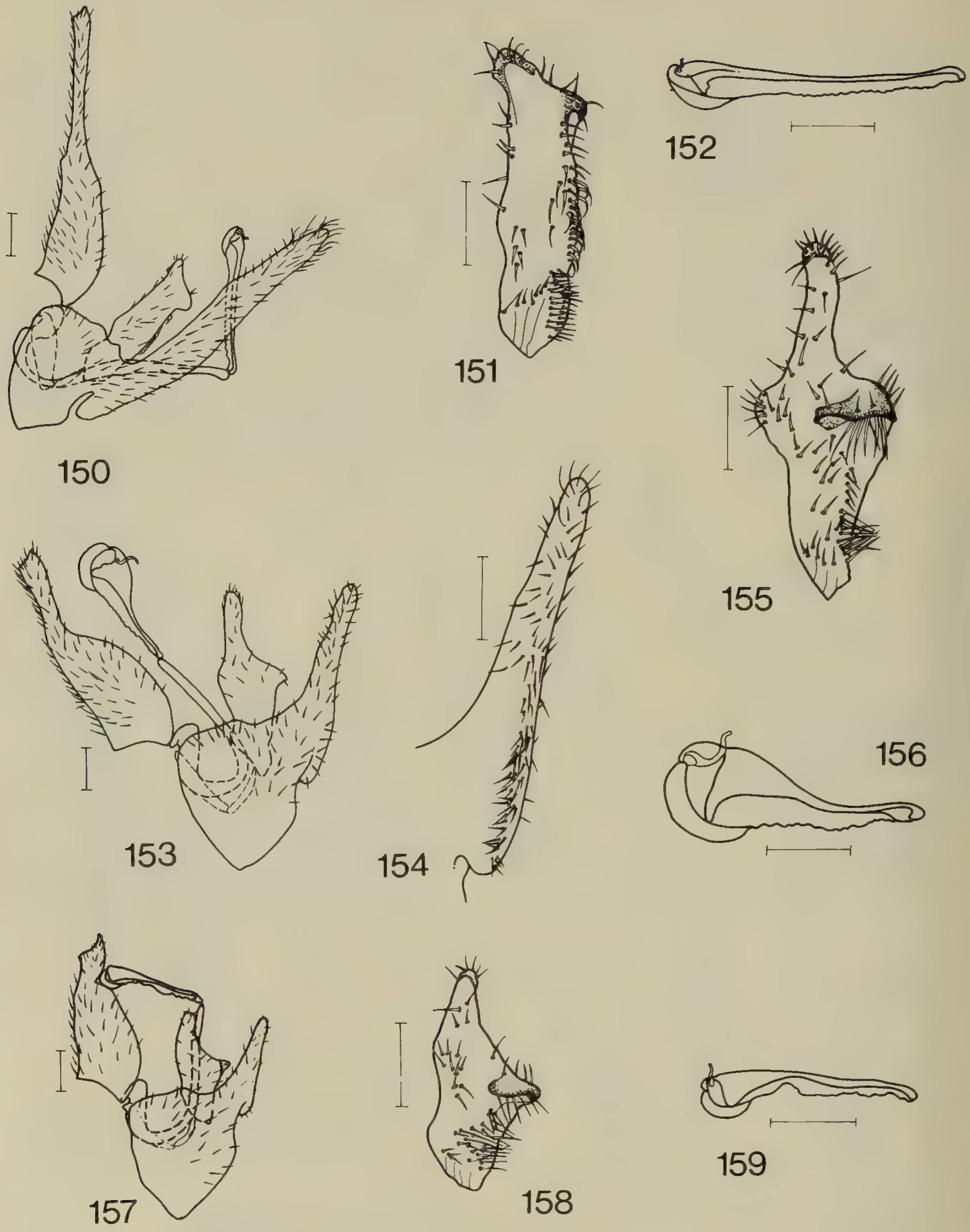

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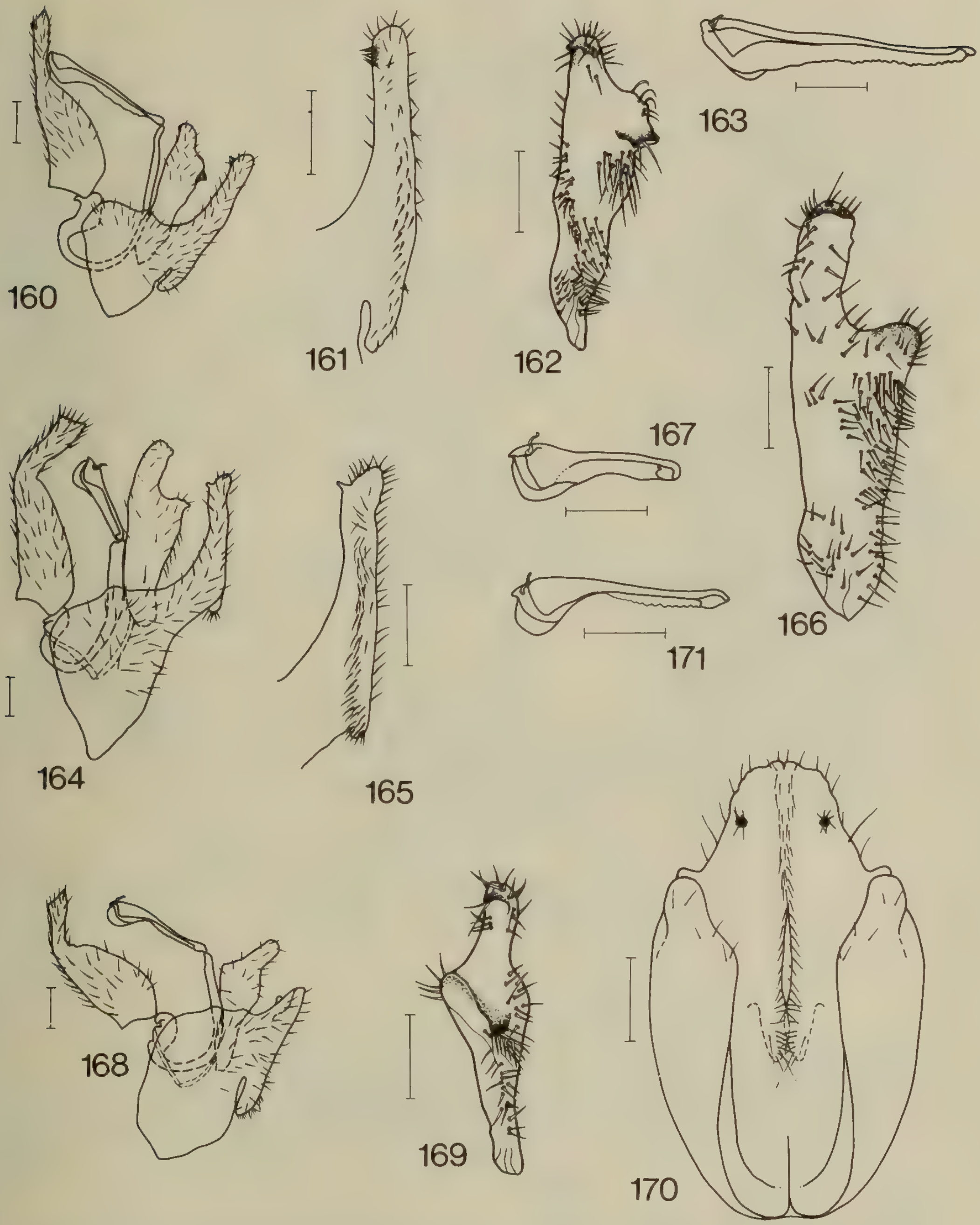

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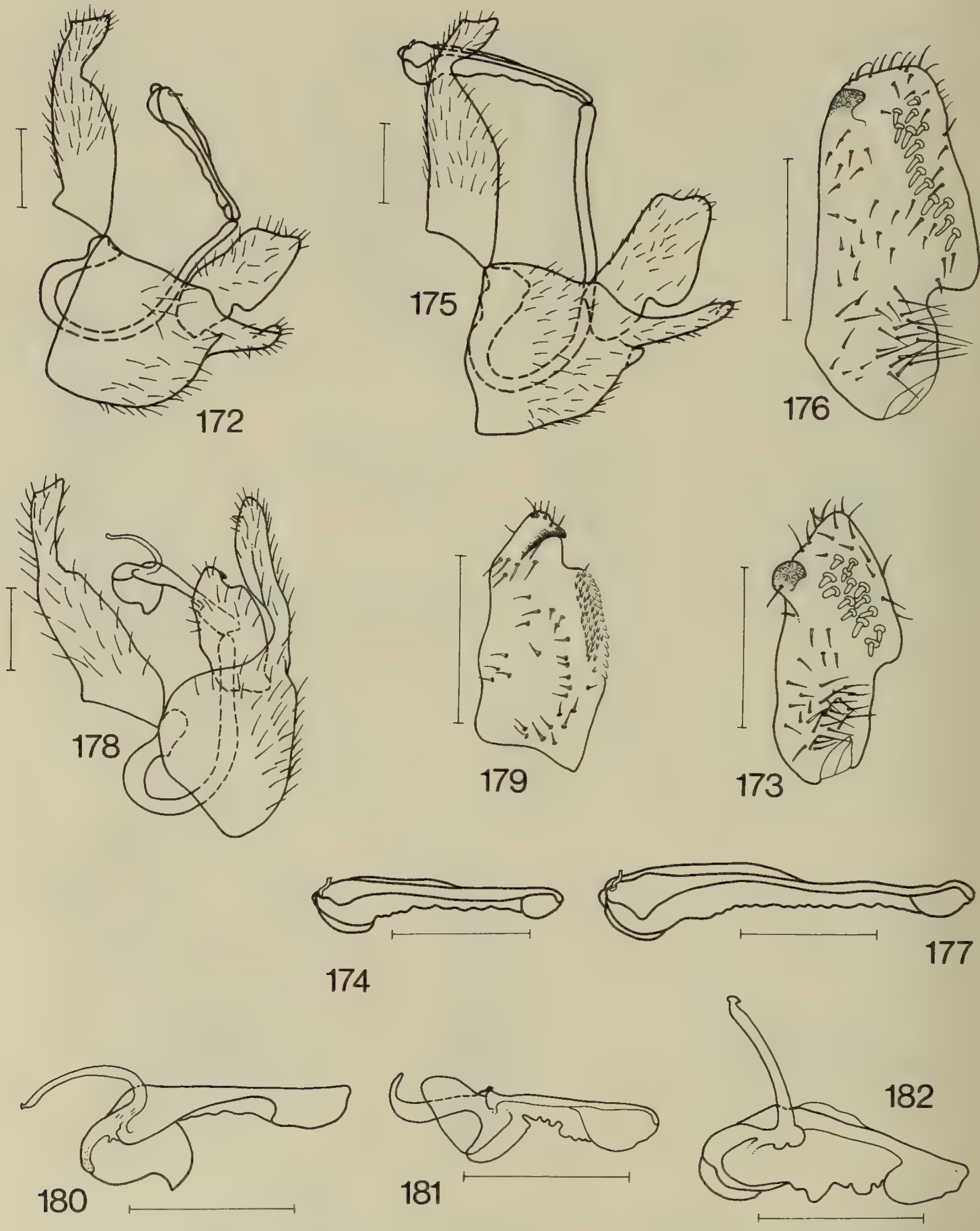

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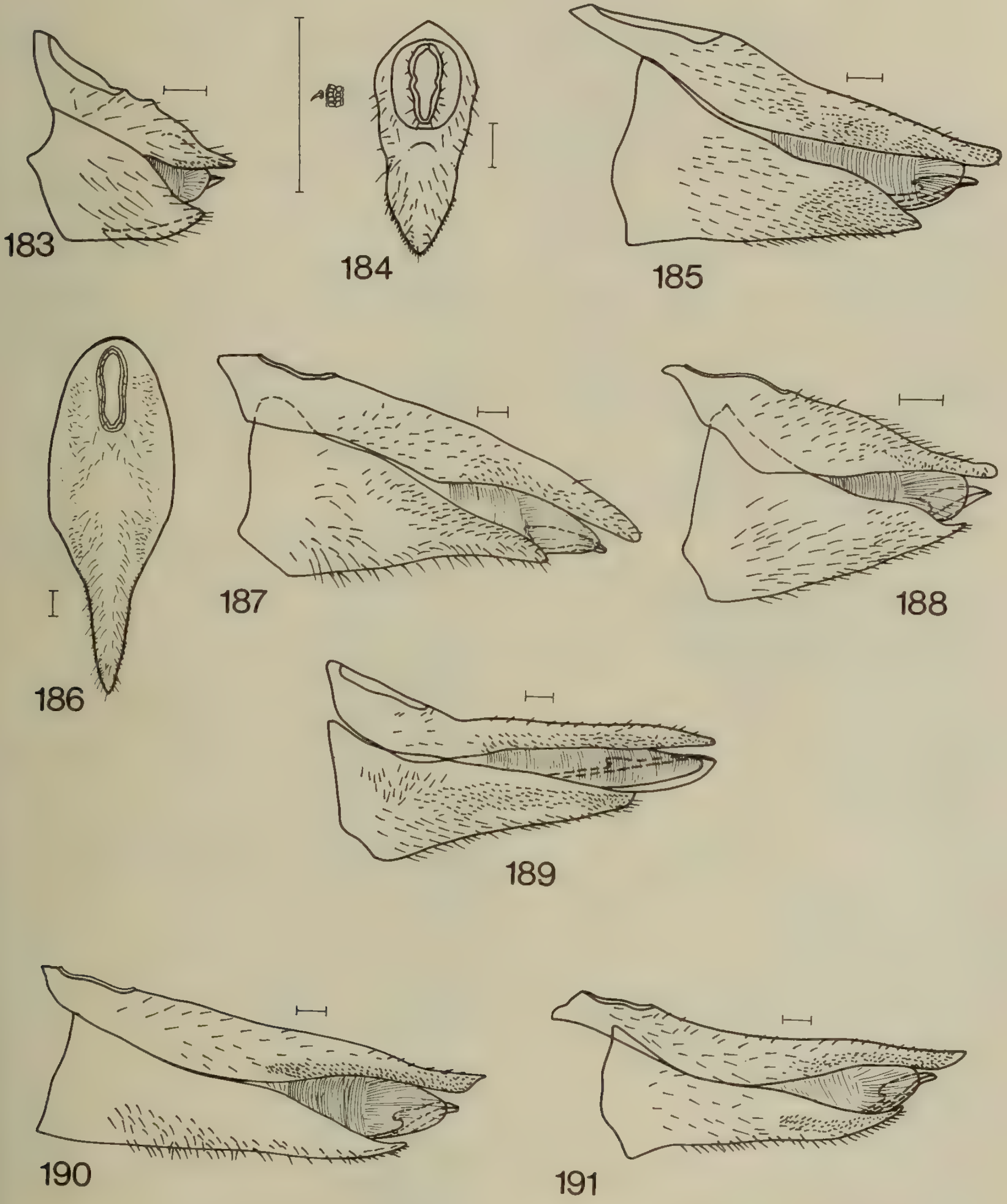

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A TAXONOMIC REVISION OF THE GENUS *ORNATIVALVA* GOZMÁNY, 1955 (LEPIDOPTERA : GELECHIIDAE)

BY

KLAUS SATTLER

Pp. 85–152; *27 Plates*; *27 Text-figures*

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A TAXONOMIC REVISION OF THE GENUS *ORNATIVALVA* GOZMÁNY, 1955 (LEPIDOPTERA : GELECHIIDAE)

By K. SATTLER

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SYNOPSIS

The Old World genus *Ornativalva* Gozmány is revised. The primary types of all but two of the discussed nominal species have been examined. Forty-three species and one subspecies are regarded as valid. Twelve new species are described and four new synonyms in species rank are established; *Nothris minutella* Turati is removed from the synonymy of *O. cerostomatella* (Walsingham) and transferred to *Anarsia* Zeller. Keys to the species are provided, head structures with frontal processes are described and illustrated for a number of species, and the biology and distribution are discussed for all species.

INTRODUCTION

SINCE the publication of a taxonomic revision of the genus *Ornativalva* Gozmány (Sattler, 1967), further collections have become available, including a number of undescribed species. Particularly valuable material was received from Dr Z.

Kaszab, Természettudományi Múzeum, Budapest, who has made several expeditions to Mongolia. As a result of Dr Kaszab's collections in Mongolia many papers were published under the title *Ergebnisse der Zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei*. The present paper is no. 362 in that series.

During his first expedition Dr Kaszab discovered the first Mongolian *Ornativalva* species. Once alerted, he paid special attention to this genus and during subsequent trips collected extensively in localities in which *Tamarix*, the host-plant of the *Ornativalva* larvae, was observed. This resulted in a collection of about 200 specimens, representing at least 17 species, 7 of which are described as new in this paper. A separate publication on the Mongolian *Ornativalva* species could not be justified, as taxonomic papers which are based entirely on a limited geographical area and include descriptions of new taxa are generally unsatisfactory. Instead, the earlier publication (Sattler, 1967) is revised to include all additional material which has become available since 1967.

In the course of the present work revised keys to the species are provided and each species is discussed. Descriptions and illustrations published previously are not repeated, but are supplemented or corrected where additional material makes this possible.

Several species are illustrated in colour (Pl. 1). The colour figures are generally based on one particular specimen; however, where no perfect model was available, the artist was supplied with additional examples to facilitate the reconstruction of parts which are damaged on the model specimen.

The measurements at the beginning of each description are those of the fore wing length of the smallest and biggest specimen measured in millimetres from the base to the apex of the wing. Sometimes only inadequate material was available, for example, rubbed specimens without fringes or specimens with curled or damaged apex and distorted wing base; therefore many measurements are necessarily approximate. Where only a limited number of specimens was available the variation in size may, of course, be greater than is indicated by the recorded measurements.

A number of *Ornativalva* species have modified head structures with enlarged scale bases, prominent frons or distinct frontal process. These structures were not described in 1967. Where applicable, descriptions and illustrations of the modified head structures are provided in this paper.

The terminology of the genitalia follows Klots (1956). A separate process at the base of the costa for which no suitable term was found is called 'harpe' in the present paper following the terminology used previously (Sattler, 1967).

Under 'Distribution' only the countries are listed; however, if a species is restricted to a limited area of a country or if it is only known from one locality, this is expressed, for example, 'Italy (Sicily)' or 'S. Iran'. All distribution records are based on material examined by myself unless stated otherwise. Each specimen is recorded in my card index and bears my determination label. Material which was considered in 1967 is not listed in the present paper; additional material is recorded under the heading 'Further material examined'.

Kaszab (1963; 1965; 1966; 1968) gave detailed accounts of his journeys in Mongolia. Each collecting site is identified by a number which also appears on the data labels of the specimens. These numbers are recorded in the present paper under 'Material examined' and follow the collector's name, for example, '(*Kaszab*, no. 840)'. The collecting sites of the British Museum (Natural History) Southern African Expedition are identified by similar numbers on the specimen labels. Photographic records and detailed information on these sites are available in the diaries of the members of the expedition and a summary will be prepared for publication.

In a few instances lectotype designations were necessary. When a species is based on an unspecified number of individuals without designation of a 'type' and there is now only one original specimen known, this is designated as the lectotype in accordance with the widely accepted interpretation of the *International Code of Zoological Nomenclature*. The question whether such a unique 'type' should be regarded as a holotype or lectotype has been discussed recently by Vane-Wright (1975 : 26–28) whose conclusions seem generally acceptable. If the only existing original specimen or one particular specimen out of a series of syntypes was clearly designated as 'the type' or 'holotype' by a subsequent author, this is accepted as a valid lectotype designation.

Walsingham usually based his new species on a 'type ♂', 'type ♀' and 'paratypes'. Mostly he lists the ♂ in the first place, but sometimes the ♀. Although this seems to indicate that he considered them as holotype, allotype and paratypes, they are all syntypes under the present *Code* and thus eligible for consideration as the lectotype. For the sake of consistency and in accordance with Walsingham's intention it seems, however, advisable to select as the lectotype the specimen which Walsingham lists in first place, unless there are good reasons for doing otherwise.

I have examined the holo- or lectotypes of all nominal species included in the present paper with the exception of *cimelion* Amsel, of which only paratypes were available, and *siewersiellus* Christoph, type-material of which could not be traced.

The literature was considered as completely as possible and over 100 papers dealing with *Ornativalva* species are recorded. All papers examined are listed in the Bibliography (pp. 143–147). A complete bibliography for each species is recorded in my card index from which detailed information will be made available on request. Bibliographic references in the systematic part of this paper are confined to publications from which unchecked information was extracted for the present study or which contain taxonomic changes, biological information and important illustrations. Misidentifications which have been corrected by re-examination of the material on which they were based are also recorded. Excluded are, in particular, check-lists and faunistic papers unless they fall into one of the above categories.

In addition to the 43 species recognized as valid in this paper, 6 doubtful species are also included. In some instances inadequate material, such as poorly preserved specimens, groups in which the sexes are doubtfully associated or in which only one sex is represented, could not be placed with certainty. These doubtful species are excluded from the keys and the check-list; however, they are discussed in the appropriate places in the systematic part as '*Ornativalva* species 1–6' and their genitalia are illustrated.

HEAD PREPARATIONS

The modified structures on the head of various *Ornativalva* species I studied and photographed with a 'Stereoscan' scanning electron microscope (Pls 5–12). The head of the moth was carefully cleared of scales by brushing with a fine snipe feather. The antennae, proboscis and labial palpi were removed and preserved in a capsule on the pin under the specimen. The denuded head was separated from the moth, mounted on a metal stub in a position that permitted examination and photography of all important aspects and coated with gold. Photographs were taken to show the dorsal, lateral and frontal view of the head. After examination the head was glued back on the specimen with a water-soluble glue. In this way the head can be studied on the moth under a binocular microscope. If required for further 'Stereoscan' examination, it can be removed again without damage to the specimen by dissolving the glue with a small drop of water.

ABBREVIATIONS OF MUSEUMS AND INSTITUTIONS

BMNH	British Museum (Natural History), London, U.K.
IE	Istituto di Entomologia, Bolzano, Italy.
LN	Landessammlungen für Naturkunde, Karlsruhe, West Germany.
MINGA	Muzeul de Istorie Naturală 'Grigore Antipa', Bucharest, Rumania.
MNHN	Muséum national d'Histoire naturelle, Paris, France.
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin, East Germany.
NM	Národní Museum, Prague, Czechoslovakia.
NM	Naturhistorisches Museum, Vienna, Austria.
RSM	Royal Scottish Museum, Edinburgh, U.K.
SMN	Staatliches Museum für Naturkunde, Stuttgart, West Germany.
TAU	Department of Zoology, Tel-Aviv University, Tel-Aviv, Israel.
TM	Transvaal Museum, Pretoria, South Africa.
TM	Természettudományi Múzeum, Budapest, Hungary.
ZSBS	Zoologische Sammlung des Bayerischen Staates, Munich, West Germany.

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The colour plate was produced by Mr B. Hargreaves, Orpington, Kent. The photographs of moths and genitalia preparations were produced by the Photographic

Unit of the BMNH. During the study of head structures I was assisted and advised by members of the Electron Microscope Unit of the BMNH.

ORNATIVALVA Gozmány, 1955

Ornativalva Gozmány, 1955, *Annls hist.-nat. Mus. natn. hung.*, S.N. **6** : 308, 309 [keys], 310.
Type-species: *Gelechia plutelliformis* Staudinger, 1859, by original designation and monotypy.
Ornativalva Gozmány; Gozmány, 1958 : 194, 196 [keys], 233.
Ornativalva Gozmány; Sattler, 1960 : 16 [keys], 59.
Pelostola Janse, 1960, *Moths S. Afr.* **6** : 188. Type-species: *Pelostola kalahariensis* Janse, 1960, by original designation and monotypy. [Synonymized by Sattler, 1967 : 34.]
Ornativalva Gozmány; Sattler, 1967 : 34.
Ornativalva Gozmány; Sattler, 1973 : 231.
Pelostola Janse; Sattler, 1973 : 236. [As synonym of *Ornativalva*.]

Head (Pls 5–12) with or without frontal modifications or processes. Ocellus present. Mandible present as small lobe. Proboscis well developed, squamose at base, apical portion with taste papillae. Maxillary palpus with four short segments. Labial palpus recurved, first segment much shorter than second; second segment with moderate brush of scales below; third segment slender, as long as or slightly longer than second (Sattler, 1967, pl. 1, fig. 3). Antenna without pecten on scape. Metascutum with paired group of narrow, hair-like scales (Text-fig. 2); in *cerostomatella*-group with broad, ovoid scales (Text-fig. 1). In fore wing veins R_4 and R_5 on long common stalk, distance R_1–R_2 about twice distance R_2–R_3. In hind wing vein M_1 free from cell near *RR*, from one point with *RR* or from short common stalk with *RR*. Frenulum of ♀ with three long setae, in some species of *cerostomatella*-group with only two setae. Humeral field on ventral surface of fore wing densely scaled, without microtrichia (Text-fig. 3). Fore wing 4·0–10·0 mm, often with characteristic pattern. Costal two-thirds of wing dark, dorsal third light between fold and dorsal margin. Light and dark zones sharply separated at fold, border line characteristically W-shaped. Light area sometimes with short dark streak on dorsal margin at base of wing. Fore wing usually smooth, rarely with groups of raised scales. In fresh specimens fore wing sometimes suffused with pink which fades under prolonged influence of daylight.

GENITALIA ♂ (Pls 13–20). Eighth tergite and sternite laterally fused, not separated into free flaps. Genitalia withdrawn inside eighth segment. One pair of coremata present at base of genitalia. Uncus poorly developed or reduced; developed and deeply divided in *cerostomatella*-group. Gnathos absent. Valva divided into two to five branches. Costa long, slender, clavate, always present, sometimes with basal process (termed 'harpe' in this paper). Valva (s. str.) always longer than costa and sacculus, usually with short apical spine. Sacculus fused with valva or clearly separated. In *ornatella*-group additional process arising in angle between valva and sacculus (Text-figs 13, 14). Anellus usually pair of weakly sclerotized lobes, densely set with setae. In some species of *cerostomatella*-group anellus lobes of characteristic shape. Aedeagus with bulbous base, slightly or strongly bent, apex often sharply pointed. Anterior part of bulbus ejaculatorius sometimes with sclerotization (Pl. 17, fig. 95).

GENITALIA ♀ (Pls 21–27). Lobus analis rectangular, wider than long, densely set with setae; row of setae with curved tips along posterior margin, in *cerostomatella*-group setae straight. Apophysis posterior short, about as long as eighth segment (including apophysis anterior). Posterior margin of eighth tergite with irregular row of setae; in *cerostomatella*-group without setae but with narrow band of scales instead (in genitalia preparations only scale bases remain) (Pl. 27, fig. 122). Apophysis anterior short, approximately one-third to one-half length of apophysis posterior, sometimes much reduced, rod-like, sometimes dilated distally. Sclerotized antrum present in some species. Ductus bursae of varying length, in some species very long, coiled. Ductus seminalis arises near ostium bursae; short section of ductus seminalis dilated near ductus bursae, inner wall of dilated section sometimes with minute spines. Inner surface of corpus bursae and sometimes anterior section of ductus bursae evenly set with minute spines. In some species (*pharaonis, serratisignella, caecigena*) spines in corpus bursae concentrated in narrow band. Corpus bursae always with signum. Typical signum with pair of strong spines, teeth or transverse ridges on irregularly shaped sclerotized basal plate; sometimes signum divided into two or signum of completely different shape.

REMARKS. On the denuded head of most *Ornativalva* species the transfrontal sulcus is externally visible as a narrow band which is free of scale bases and runs in a gentle arc between the antennal pits. (In this paper the transfrontal sulcus is taken as the dividing line between vertex and frons.) Below the transfrontal sulcus the scale bases are evenly distributed over most of the frontal region but more densely concentrated along the margin of the eyes. A narrow band between the tentorial pits is completely free of scale bases. Above the transfrontal sulcus the scale bases are unevenly distributed, with the densest concentration laterally and along the posterior margin of the head. The centre of the vertex is an area of low density and in some species (*pulchella, frontella, cerostomatella* and others) can be completely free of scale bases. The density of scale bases is not a direct indication of the density of the scale cover above a given point of the head surface. The areas which are free or almost free of scale bases are usually covered by scales arising on neighbouring areas. The bare patches on the vertex are covered by scales which arise laterally and point towards the centre line of the head.

In some species of the *erubescens*-group and all but one of the *cerostomatella*-group, modifications of the frontal region occur. The scale bases below the transfrontal sulcus and immediately above it can be reduced in numbers and raised to form small knobs or teeth. They can be concentrated immediately below the transfrontal sulcus and form a more or less pronounced process. The scale bases immediately above the transfrontal sulcus can form a regular or irregular arc. The most extreme development of frontal processes is found in some species of the *cerostomatella*-group (*cornifrons* and some forms of *mixolitha*) (Pls 8–12).

The frontal modifications are usually hidden under the scale cover of the head and can be easily overlooked unless the head is denuded for examination. Even in species with extreme processes only the tip may be visible among the scales.

Nothing appears to be known about the function of such modifications of the frontal region. In some instances fine particles of sand were found among the raised scale bases. This suggests that some species pupate in the ground and that the moth has to bore through a layer of soil after emerging from the pupa. A strengthening of the frons would seem advantageous for such purposes; however, numerous species of moths manage perfectly well under identical conditions without such modifications.

Head processes have developed independently in several families of Lepidoptera, for example, Cosmopterigidae, Symmocidae, Pyralidae (Crambinae, Phycitinae), Geometridae, Thyrididae, Noctuidae and Thaumetopoeidae. In the Gelechiidae modifications of the frons occur independently in a number of genera, for example, *Lita* Treitschke, *Rhynchopacha* Staudinger, *Cerofrontia* Janse, *Scrobipalpa* Janse, *Ilseopsis* Povolný and others.

Species with frontal processes are found in different parts of the world; however, in the Gelechiidae there is a notable concentration in arid areas of the Palaearctic and Nearctic regions. In the Palaearctic region Gelechiidae with frontal modifications occur from Morocco through North Africa, the Near and Middle East to western India and Central Asia, with a particular concentration in Mongolia.

Frontal processes are found in both sexes and no sexual dimorphism was observed in this character.

In *Ornativalva mixolitha* considerable variation of the frontal structures is found. The majority of specimens have no definite process but merely enlarged scale bases which are evenly distributed, whereas a distinct process is developed in specimens from Turkey and Mongolia. In southern Iran specimens with and without process and intermediate stages were found.

In most Gelechiidae the metascutum is bare except for a paired group of modified scales near its posterior margin. The long, narrow, hair-like scales point in a postero-medial direction. The scutellum is covered with normal body-covering scales. In the species of the *cerostomatella*-group the scales on metascutum and scutellum are short, broad, ovoid and arranged in a shingled manner (Text-figs 1, 2). The function of this structure, which is equally developed in both sexes, and the significance of its modification in the *cerostomatella*-group of the genus *Ornativalva* is unknown. Such modification is also found elsewhere in the Gelechiidae, for example, in *Rhynchopacha gussakovskii* (Gerasimov), which differs in that character from all other *Rhynchopacha* species. Like the species of the *cerostomatella*-group *R. gussakovskii* has also a frontal process; however, there is no correlation between frontal process and scale structure of the metascutum and there are many species of Gelechiidae with frontal process but hair-like scales on the metascutum.

Differences between species are found in the wing shape and some species of the *cerostomatella*-group (*cerostomatella*, *cornifrons*) differ more strongly from the majority of the *Ornativalva* species (Text-figs 3–12). No sexual differences in the wing shape of *Ornativalva* species were observed.

For examination of the ♀ frenulum it is recommended to look at both pairs of wings as there are specimens which have lost a seta or acquired an additional one, usually on one side only.

The humeral field, a basal area on the ventral surface of the fore wing, between costa, subcosta and humeral cross-vein (Text-fig. 3) bears in many species of Lepidoptera a group of microtrichia. The presence or absence of the microtrichia was used by some authors to separate Gelechiidae and Scythrididae; however, this character is so variable in the Gelechiidae that it has no significance at the family level. Several species of *Ornativalva* were examined but no microtrichia were found.

The ductus bursae can reach considerable length in some species and is then coiled inside the abdomen. When uncoiled and fully extended in a preparation, it can measure up to three times the length of the extended abdomen. There appears to be some correlation between the length of the ductus ejaculatorius of the ♂ and the ductus bursae of the ♀. *O. rufipuncta* and *longiductella* with an exceptionally long ductus bursae have also an extremely long ductus ejaculatorius. This is not surprising when we consider that the spermatophore may be partially formed in the ductus ejaculatorius during copulation. The spermatophore is probably globular with a long coiled stalk that reaches the posterior part of the ductus bursae where the ductus seminalis branches off. Remnants of the spermatophore were found during preparation in the ductus bursae of *rufipuncta*.

BIOLOGY. The genus *Ornativalva* appears to be closely associated with the plant genus *Tamarix* (Tamaricaceae). The larvae of twelve *Ornativalva* species were reared on *Tamarix* species. Many more species were collected as adults flying among *Tamarix*, indicating that their larvae can likewise be expected to feed on that plant genus. The larva of *O. heluanensis* was reared on *Tamarix* and *Frankenia* (Frankeniaceae). Frankeniaceae are considered to be closely related to Tamaricaceae. One specimen of *O. plutelliformis* is labelled '*Rhus oxyacanthe*', but it is unlikely that *Rhus* is the host-plant of the larva of any *Ornativalva* species. Relatively few *Ornativalva* species were collected in the larval stage and then only in a small number of localities. There is no indication at this stage that *Ornativalva* species are host-specific within the genus *Tamarix*. The comparison of the distribution patterns of *Tamarix* species and *Ornativalva* species indicates that widely distributed species must have different host-plants in different parts of their range. This is confirmed by the fact that several different species of *Tamarix* were recorded for *O. plutelliformis*. The species of *Tamarix* are not always easy to identify. A number of species were recorded as host-plants of *Ornativalva* species; however, some are clearly misidentifications whereas others remain doubtful. The host-plants are discussed under each species in the taxonomic section. The nomenclature of the *Tamarix* species in this paper follows Baum (1966).

EGG. Unknown. It is possibly deposited singly on the terminal shoots of *Tamarix*, where the larva is known to feed.

LARVA. The chaetotaxy of the larvae has never been studied. Descriptions of colour and pattern exist for several species. Two colour forms (green and pink) of the larva of *plutelliformis* were illustrated by Millière (1861, (liv.4) pl. 1, figs 1, 2). Most of the descriptions are not comparative and thus of little value. Misidentifications are frequent and authors were sometimes dealing with a mixed series of larvae.

According to the literature the larva lives in a silken tube or free on the terminal shoots, leaves or flowers of *Tamarix* species. *O. heluanensis* was also recorded as mining the succulent leaves of *Frankenia*.

PUPA. Superficial descriptions exist for a few species. The pupa of *plutelliformis* was illustrated in colour by Millière (1861, (liv. 4) pl. 1, fig. 3); however, the figure is too small and shows little. The existing descriptions are unsuitable for comparison and the identification of the species is often doubtful.

According to the literature *Ornativalva* species pupate on or in the ground in a cocoon that is covered with small particles of soil. In areas where hibernation is required this takes place in the pupal stage.

ADULT. Little is known about the habits of the moths. Mann observed adults of *tamariciella* flying and mating before and after sunset (Zeller, 1850 : 153). The *Ornativalva* species are readily attracted to light and most species have been collected that way. No observations exist on the number of generations per year, but all indications are that *Ornativalva* species breed continuously where climatic conditions are right. The most common and widely distributed *heluanensis* and *plutelliformis* were collected as adults in every month of the year. Clear-cut generations probably exist in areas with distinct seasons.

DISTRIBUTION. The distribution of the genus *Ornativalva* coincides almost completely with that of the plant genus *Tamarix*. *Ornativalva* species are known from the Cape Verde Islands, Canary Islands and Madeira through southern Europe and North Africa to India and Mongolia. No species are known from China, where *Tamarix* also occurs. In the south some species are known from the Sudan and Socotra. An isolated species occurs in South Africa.

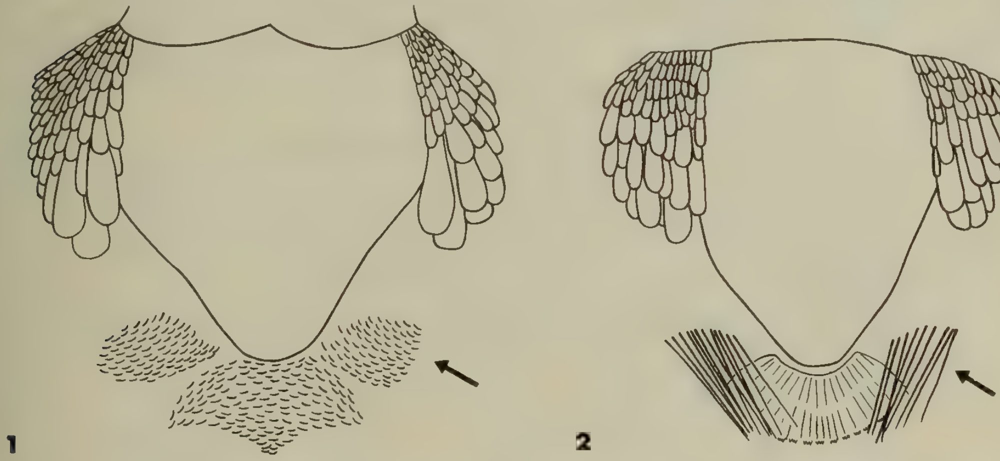
THE SYSTEMATIC POSITION OF *ORNATIVALVA*

Gozmány (1955 : 310; 1958 : 233), in his papers on the Hungarian Gelechiidae, placed the genus *Ornativalva* between *Friseria* Busck and *Chionodes* Hübner; however, its relationship to other genera was not discussed. The genus *Friseria* is American in distribution and not yet recorded from the Palaearctic region; the only Hungarian species included by Gozmány belongs to *Rhynchopacha* Staudinger. There is no evidence that *Ornativalva* is closely related to either *Chionodes* or *Rhynchopacha*.

Janse (1960 : 188), who described the genus as *Pelostola* in his work on the South African Gelechiidae, placed it 'near to *Scrobipalpa* and *Melitoxoides*'. Neither genus is morphologically similar to *Ornativalva*.

The placement of *Ornativalva* between *Altenia* Sattler and *Gladiovalva* Sattler (Sattler, 1960 : 59) was arbitrary and not based on affinities.

The higher classification of the Gelechiidae is still poorly understood. A number of subfamilies have been separated, but most of them have never been defined properly and the subfamily Gelechiinae remains a heterogeneous assemblage of all the genera which could not be assigned with certainty to any other subfamily.



FIGS 1, 2. Thorax of *Ornativalva* species. 1, *cerostomatella*-group. 2, *heluanensis*-group – *plutelliformis*-group.

The Gelechiinae are at present subdivided into three tribes, Teleiodini, Gnorimoschemini and Gelechiini, the last comprising a mixture of genera which could not be assigned with certainty to one of the other two tribes. As the tribes are defined at present, *Ornativalva* can only be included in the Gelechiini. *Ornativalva* does not appear to have close morphological affinities to any other genus and in particular is not related to the other *Tamarix*-feeders in the Gelechiidae. For practical purposes *Ornativalva* should remain next to *Chionodes* until a more appropriate place can be suggested.

KEY TO THE SPECIES OF *ORNATIVALVA*: MALES

(*Note.* The ♂ of *undella* is unknown.)

1		South African species	***kalahariensis*** (p. 127)
–		Palaearctic species	2
2	(1)	Metascutum with short broad scales (Text-fig. 1); uncus divided	3
–		Metascutum with long narrow scales (Text-fig. 2); uncus not divided	9
3	(2)	Fore wing with dark longitudinal band; costa and dorsal margin light	4
–		Fore wing without clearly defined longitudinal band; costa usually dark, dorsal margin lighter	6
4	(3)	Frons with strong process (Pl. 12, figs 78–80); ground colour of fore wing white	***cornifrons*** (p. 138)
–		Frons weakly or strongly prominent but without process; ground colour of fore wing ochreous	5
5	(4)	Distal half of valva much narrower than basal half; frons hardly prominent (Pl. 9, figs 60–62)	***cerostomatella*** (p. 139)
–		Distal half of valva hardly narrower than basal half; frons strongly prominent (Pl. 10, figs 63–65)	***mongolica*** (p. 140)
6	(3)	Distal portion of valva strongly curved dorsad	7
–		Distal portion of valva straight	8
7	(6)	Frons with short cylindrical process (Pl. 11, figs 69–74)	***afghana*** (p. 141)
–		Frons prominent, without cylindrical process (Pl. 10, figs 66–68)	***curvella*** (p. 142)
8	(6)	Base of anellus bulged	***angulatella*** (p. 137)
–		Base of anellus not bulged	***mixolitha*** (p. 135)
9	(2)	Sacculus developed, clearly separated from valva	10
–		No separate sacculus developed	38
10	(9)	Frons with process and enlarged scale bases (Pls 6, 7, figs 39–50)	11
–		Frons not modified	14
11	(10)	Fore wing with basal streak (Pl. 1, fig. 4; Pl. 2, fig. 20)	***frontella*** (p. 114)
–		Fore wing without basal streak	12
12	(11)	Harpe clavate	***lilyella*** (p. 108)
–		Harpe digitate	13
13	(12)	Sacculus broadest near base (Pl. 14, fig. 85)	***aspera*** (p. 109)
–		Sacculus broadest distally (Pl. 14, fig. 86)	***pulchella*** (p. 110)
14	(10)	Fore wing with basal streak	15
–		Fore wing without basal streak	22
15	(14)	Conspicuous process between valva and sacculus (Pl. 16, fig. 92; Text-figs 13, 14)	***ornatella*** (p. 116)
–		No process between valva and sacculus	16
16	(15)	Distal half of sacculus separated from valva	17
–		Sacculus fused with valva for most of its length	20

17 (16)	Sacculus somewhat dilated in distal half	18
–	Sacculus not dilated in distal half	19
18 (17)	Sacculus broadest near apex (Pl. 19, fig. 99)	***basistriga*** (p. 130)
–	Sacculus broadest at three-quarters, distal portion narrow (Pl. 18, fig. 98)	***singula*** (p. 129)
19 (17)	Harpe long, digitate	***sieversi*** (p. 134)
–	Harpe short, rounded	***heligmatodes*** (p. 124)
20 (16)	Apex of aedeagus sharply bent	***erubescens*** (p. 108)
–	Apex of aedeagus gently curved	21
21 (20)	Harpe clavate	***arabica*** (p. 114)
–	Harpe globular (Pl. 14, fig. 84)	***levifrons*** (p. 107)
22 (14)	Harpe absent	***ignota*** (p. 115)
–	Harpe present	23
23 (22)	Harpe angulate, with sharp point	***pharaonis*** (p. 120)
–	Harpe rounded or digitate	24
24 (23)	Aedeagus with rounded or truncate apex	25
–	Aedeagus pointed	27
25 (24)	Costa clavate	26
–	Costa not clavate (Pl. 18, fig. 96); fore wing with raised scales (Pl. 1, fig. 7)	***caecigena*** (p. 123)
26 (25)	Valva strongly bent in middle (Pl. 17, fig. 93)	***plicella*** (p. 118)
–	Valva straight, not bent in middle	***macrosignella*** (p. 123)
27 (24)	Harpe digitate, at least half length of costa	28
–	Harpe rounded, short	33
28 (27)	Valva strongly bent in middle (Pl. 15, fig. 87)	***ochraceofusca*** (p. 111)
–	Valva not bent in middle	29
29 (28)	Sacculus about twice as long as wide	***sesostrella*** (p. 115)
–	Sacculus much longer than wide	30
30 (29)	Distal half of sacculus narrower than basal half	31
–	Distal half of sacculus not narrower than basal half	32
31 (30)	Aedeagus curved, S-shaped	***antipyramis*** (p. 128)
–	Aedeagus curved but not S-shaped	***triangulella*** (p. 128)
32 (30)	Bulbous base of aedeagus as long as narrow apical portion	***plutelliformis*** (p. 131)
–	Bulbous base of aedeagus shorter than narrow apical portion	***grisea*** (p. 133)
33 (27)	Fore wing with small groups of raised scales	***indica*** (p. 120)
–	Fore wing smooth, without raised scales	34
34 (33)	Posterior margin of anellus with circular emargination (Pl. 17, fig. 94)	***misma*** (p. 121)
–	Posterior margin of anellus without emargination	35
35 (34)	Sacculus broad at base (Pl. 17, fig. 95)	***serratisignella*** (p. 122)
–	Sacculus narrow	36
36 (35)	Sacculus short, hardly extending beyond harpe	***pseudotamariciella*** (p. 126)
–	Sacculus long, extending well beyond harpe	37
37 (36)	Narrow distal portion of aedeagus clearly separated from bulbous base	***heligmatodes*** (p. 124)
–	Narrow distal portion of aedeagus not clearly separated from bulbous base	***tamariciella*** (p. 125)
38 (9)	Uncus pointed (Pl. 20, fig. 104)	***acutivalva*** (p. 142)
–	Uncus more or less truncate	39
39 (38)	Harpe a short process	40
–	Harpe absent	42
40 (39)	Ductus ejaculatorius about half as long as abdomen	***heluanensis*** (p. 101)
–	Ductus ejaculatorius about as long as abdomen	41
41 (40)	Apical portion of aedeagus strongly curved (Pl. 13, fig. 83)	***rufipuncta*** (p. 104)

– Apical portion of aedeagus gently curved . . . ***longiductella*** (p. 104)
42 (39) Apical portion of aedeagus strongly curved, twice length of bulbous base ***roseosuffusella*** (p. 104)
– Apical portion of aedeagus gently curved, not longer than bulbous base ***zonella*** (p. 105)

KEY TO THE SPECIES OF *ORNATIVALVA*: FEMALES

(*Note*. The ♀ of *curvella* is unknown.)

1 South African species . . . . . . ***kalahariensis*** (p. 127)
– Palaearctic species 2
2 (1) Metascutum with short broad scales (Text-fig. 1) 3
– Metascutum with long narrow scales (Text-fig. 2) 8
3 (2) Frenulum with two setae (Text-fig. 12) 4
– Frenulum with three setae (Text-figs 3, 5–7, 9) 6
4 (3) Fore wing white with black longitudinal band (Pl. 1, fig. 13; Pl. 4, fig. 29); frons with strong process (Pl. 12, figs 78–80) . . . ***cornifrons*** (p. 138)
– Fore wing ochreous or grey; frons with or without process 5
5 (4) Fore wing ochreous with dark longitudinal band (Pl. 1, fig. 10; Pl. 4, fig. 30) ***mongolica*** (p. 140)
– Fore wing without longitudinal band (Pl. 1, fig. 9; Pl. 4, fig. 28) ***mixolitha*** (p. 135)
6 (3) Frontal process truncate (Pl. 11, figs 69–74) . . . . ***afghana*** (p. 141)
– No frontal process developed 7
7 (6) Fore wing ochreous with broad longitudinal band . ***cerostomatella*** (p. 139)
– Fore wing without distinct longitudinal band . . . ***angulatella*** (p. 137)
8 (2) Frons with process or enlarged scale bases (Pls 6, 7) 9
– Frons without modifications 12
9 (8) Fore wing with basal streak (Pl. 1, fig. 4; Pl. 2, fig. 20) . ***frontella*** (p. 114)
– Fore wing without basal streak 10
10 (9) Antrum nearly as long as apophysis anterior . . . ***lilyella*** (p. 108)
– Antrum much shorter than apophysis anterior 11
11 (10) Vertex with distinct arc of enlarged scale bases (Pl. 6, figs 42–44) . ***aspera*** (p. 109)
– Enlarged scale bases on vertex not forming arc (Pl. 7, figs 45–47) ***pulchella*** (p. 110)
12 (8) Fore wing with basal streak 13
– Fore wing without basal streak 21
13 (12) Antrum longer than apophysis anterior . . . . ***erubescens*** (p. 108)
– Antrum shorter than apophysis anterior or absent 14
14 (13) Signum with pair of strong spines 15
– Signum with pair of transverse folds or ridges 18
15 (14) Signum spines at least twice as long as signum is wide . ***heligmatodes*** (p. 124)
– Signum spines hardly longer than their basal plates are wide . . . 16
16 (15) Antrum with longitudinal fold; apophysis anterior usually dilated distally (Text-figs 15–17) . . . . ***ornatella*** (p. 116)
– Antrum, when present, without longitudinal fold; apophysis anterior distally not dilated 17
17 (16) Eighth sternite with pair of longitudinal folds; antrum a short tube (Pl. 26, fig. 119) . . . . ***singula*** (p. 129)
– Eighth sternite without longitudinal folds; no tubular antrum . ***sieversi*** (p. 134)
18 (14) Eighth tergite with scale bases (Pl. 27, fig. 125) . . . ***acutivalva*** (p. 142)
– Posterior margin of eighth tergite with row of setae; no scale bases . . 19

19 (18) No sclerotized antrum (Pl. 26, fig. 120) ***basistriga*** (p. 130)

– Antrum short, tubular 20

20 (19) Fore wing between costa and fold uniformly dark brown ***arabica*** (p. 114)

– Fore wing between costa and fold with light zone (Pl. 1, fig. 1; Pl. 2, fig. 17) ***levifrons*** (p. 107)

21 (12) Signum with pair of strong spines; spines more or less circular in cross-section 22

– Signum of different shape or spines not circular in cross-section 31

22 (21) Signum spines longer than signum is wide (Pl. 22, fig. 110) ***ochraceofusca*** (p. 111)

– Signum spines as long as signum is wide or shorter 23

23 (22) Ductus bursae much longer than abdomen 24

– Ductus bursae not longer than abdomen 26

24 (23) Apophysis anterior rod-like; antrum as long as or longer than apophysis anterior (Pl. 21, fig. 106) ***rufipuncta*** (p. 104)

– Apophysis anterior not rod-like; antrum absent or shorter than apophysis anterior 25

25 (24) Apophysis anterior reduced; antrum absent ***roseosuffusella*** (p. 105)

– Apophysis anterior broad; antrum shorter than apophysis anterior ***longiductella*** (p. 104)

26 (23) Antrum short, tubular 27

– Antrum absent, when present not tubular 29

27 (26) Base plates of signum separate or connected by narrow sclerotized bridge 28

– Base plate of signum broad, hardly constricted medially ***triangulella*** (p. 128)

28 (27) Antrum more than half length of apophysis anterior (Pl. 23, fig. 112) ***ignota*** (p. 115)

– Antrum at most half length of apophysis anterior ***sesostrella*** (p. 115)

29 (26) Apophysis anterior reduced ***zonella*** (p. 105)

– Apophysis anterior clearly developed 30

30 (29) Antrum absent (Pl. 21, fig. 105) ***heluanensis*** (p. 101)

– Short antrum present ***plutelliformis*** (p. 131)

31 (21) Single signum without pair of spines or processes 32

– Two separate signa or signum with paired processes 33

32 (31) Signum a narrow transverse band without spines ***tamariciella*** (p. 125)

– Signum longitudinal, large, with small spines ***macrosignella*** (p. 123)

33 (31) Posterior third of ductus bursae straight, not coiled, weakly sclerotized 34

– Entire ductus bursae coiled, membranous 35

34 (33) Apophysis anterior almost as long as apophysis posterior (Pl. 25, fig. 117) ***misma*** (p. 121)

– Apophysis anterior much shorter than apophysis posterior ***pharaonis*** (p. 120)

35 (33) Cervix bursae with one or two sclerotized folds near opening of corpus bursae 36

– Cervix bursae or ductus bursae without sclerotizations near opening of corpus bursae 37

36 (35) Antrum longer than apophysis anterior; cervix bursae with one sclerotized fold (Pl. 24, fig. 115) ***undella*** (p. 118)

– Antrum absent; cervix bursae with two sclerotized folds (Pl. 24, fig. 114) ***plicella*** (p. 118)

37 (35) Signum a pair of irregular base plates with transverse folds or ridges 38

– Signum of different shape 39

38 (37) Antrum medially at posterior margin with pair of longitudinal folds ***antipyramis*** (p. 128)

– Antrum not developed ***grisea*** (p. 133)

39 (37) Signum a narrow sclerotized band 40

– Signum not band-like 41

40 (39) Signum with pair of folds ***pseudotamariciella*** (p. 126)

– Signum with pair of broad terminal teeth . . . . . ***indica*** (p. 120)
41 (39) Signum with pair of strong spines; edges of spines smooth . ***heligmatodes*** (p. 124)
– Signum with pair of processes with serrated edges 42
42 (41) Processes of signum serrated along one edge . . . ***caecigena*** (p. 123)
– Processes of signum serrated along both edges . . ***serratisignella*** (p. 122)

CHECK-LIST OF THE SPECIES OF *ORNATIVALVA*

ORNATIVALVA Gozmány, 1955
PELOSTOLA Janse, 1960

heluanensis-group
heluanensis (Debski, 1913)
frankeniivorella Chrétien, 1917
oasicolella Turati, 1924, **syn. n.**
siculella Mariani, 1937, **syn. n.**
longiductella Sattler, 1967
rufipuncta **sp. n.**
roseosuffusella Sattler, 1967
zonella (Chrétien, 1917)
cimelion Amsel, 1935, **syn. n.**
iranella Sattler, 1967, **syn. n.**

erubescens-group
levifrons **sp. n.**
erubescens (Walsingham, 1904)
lilyella (Lucas, 1944)
aspera **sp. n.**
pulchella **sp. n.**
ochraceofusca Sattler, 1967
frontella **sp. n.**
arabica Sattler, 1967
sesostrella (Rebel, 1912)
ignota Sattler, 1967
ornatella-group
ornatella Sattler, 1967

plicella-group
plicella **sp. n.**
undella **sp. n.**

tamariciella-group
indica Sattler, 1967
pharaonis Sattler, 1967
misma **sp. n.**
serratisignella Sattler, 1967
caecigena (Meyrick, 1918)
macrosignella Sattler, 1967
heligmatodes (Walsingham, 1904)
tamariciella (Zeller, 1850)
pseudotamariciella Sattler, 1967
kalahariensis (Janse, 1960)

plutelliformis-group
triangulella Sattler, 1967
antipyramis (Meyrick, 1925)

singula Sattler, 1967
basistriga sp. n.
plutelliformis (Staudinger, 1859)
  olbiaella Millière, 1861
  siewersiellus Christoph, 1867
  sinuatella Walsingham, 1904
grisea Sattler, 1967
sieversi (Staudinger, 1871)

cerostomatella-group
mixolitha mixolitha (Meyrick, 1918)
mixolitha bipunctella Sattler, 1967
angulatella (Chrétien, 1915)
  nigrosubvittatella Lucas, 1933
cornifrons sp. n.
cerostomatella (Walsingham, 1904)
  tripartitella Mabille, 1907
  cerostomella Meyrick, 1925
  biclavata Meyrick, 1934
mongolica Sattler, 1967
afghana Sattler, 1967
curvella sp. n.
acutivalva sp. n.

THE *HELUANENSIS*-GROUP

(Text-fig. 3)

Head without enlarged scale bases or frontal process. Metascutum with paired group of narrow, hair-like scales (Text-fig. 2). Fore wing without basal streak on inner margin. Frenulum of ♀ triple. In ♂ genitalia uncus reduced; costa and valva present, harpe short or absent; sacculus not separated from valva. Anellus membranous. Aedeagus of some species with very long ductus ejaculatorius. In ♀ genitalia posterior margin of eighth tergite with irregular row of long setae. Apophysis anterior short or reduced, in *rufipuncta* longer. Sclerotized antrum generally absent, in *longiductella* short, in *rufipuncta* well developed. Ductus bursae extremely long in some species. Signum not divided, with pair of strong spines.

BIOLOGY. *O. heluanensis* and *zonella* have been bred on *Tamarix* species, *heluanensis* also on *Frankenia*.

Ornativalva heluanensis (Debski, 1913)

(Pl. 13, fig. 81; Pl. 21, fig. 105; Text-fig. 3)

Teleia heluanensis Debski, 1913, *in* Andres, *Bull. Soc. ent. Egypte* **3** : 111. Lectotype ♂, EGYPT: Helwân, larva on *Tamarix*, 6. iv., moth emerged 4.v.1910 (*Debski*) (genitalia slide no. 3063; NM, Vienna), designated by Sattler (1967 : 88) [examined].

[*Teleia tamariciella* (Zeller); Rebel, 1912 : 90 (partim). Misidentification.]

[*Teleia tamariciella* (Zeller); Chrétien, 1917 : 473. Erroneously cited as *tamariciella* Mann. Misidentification.]

Teleia frankeniivorella Chrétien, 1917, *Annls Soc. ent. Fr.* **85** : 474. Lectotype ♀, ALGERIA: Biskra, larva on *Frankenia*, 11.–12.xi.1911, moth emerged 27.iii.1912 (*Chrétien*) (genitalia slide no. 387a, Sattler; MNHN, Paris), designated by Sattler (1967 : 87) [examined]. [Synonymized by Sattler, 1967 : 39.]

Teleja [sic] *oasicolella* Turati, 1924, *Atti Soc. ital. Sci. nat.* **63** : 161, pl. 6, fig. 4 [poor colour photograph]. LECTOTYPE ♀, LIBYA: Cyrenaica, Bengasi, Saluk, 24. iv. (*Krüger*) (genitalia slide no. 685, Sattler; coll. Turati, IE, Bolzano), here designated [examined]. **Syn. n.**

Gelechia frankeniivorella (Chrétien) Meyrick, 1925*a* : 78.

Gelechia heluanensis (Debski) Meyrick, 1925*a* : 84.

[*Teleia tamaricalis* (Zeller); Amsel, 1933 : 125 (partim). Incorrect subsequent spelling of *tamariciella* Zeller. Misidentification.]

[*Teleia tamariciella* (Zeller); Amsel, 1935*b* : 263 (partim). Misidentification.]

Telphusa oasicolella (Turati) Gaede, 1937 : 131.

Gelechia frankeniivorella (Chrétien); Gaede, 1937 : 173.

Gelechia heluanensis (Debski); Gaede, 1937 : 177.

Lita siculella Mariani, 1937, *G. Sci. nat. econ. Palermo* **39**(3) : 9, pl. 1, fig. 1. LECTOTYPE ♂, ITALY: Sicily, Prov. Palermo, Casteldaccia, 23.ix.1927 (*Mariani*) (genitalia slide no. 631, Povolný; MNHU, Berlin), here designated [examined]. **Syn. n.**

[*Teleia tamariciella* (Zeller); Amsel, 1955*a* : 28. Misidentification.]

[*Teleia tamariciella* (Zeller); Amsel, 1959 : 32. Misidentification.]

[*Ornativalva trifasciella* (Rebel) Sattler, 1960 : 59. Misidentification.]

Ornativalva frankeniivorella (Chrétien) Sattler, 1964 : 577.

Ornativalva frankeniivorella (Chrétien); Amsel, 1966 : 128.

Ornativalva heluanensis (Debski) Sattler, 1967 : 38, 88, pl. 1, fig. 5, pl. 3, figs 15, 16, pl. 9, fig. 45.

Ornativalva heluanensis (Debski); Amsel, 1968 : 17.

GENITALIA ♂. Pl. 13, fig. 81.
GENITALIA ♀. Pl. 21, fig. 105.

REMARKS. The observations of Debski (1913 : 110–112) on the larvae are incorrect or unreliable. He observed two different types of larvae, both feeding on *Tamarix tetragyna* Ehrenberg and *T. nilotica* (Ehrenberg) Bunge. The larva described on the specimen labels as 'larva libera bicornuta' he attributed to *tamariciella* (Debski, 1913 : 110); however, from his detailed description it is clear that this was not a gelechiid larva but probably that of an *Agdistis* species (Pterophoridae) (Chrétien, 1917 : 473). The second larval type, described as 'larva tubicola', Debski attributed to *heluanensis*. I have examined five of Debski's specimens. One 'ex larva libera bicornuta' and two 'ex larva tubicola' are *heluanensis*, while one 'ex larva libera bicornuta' and one 'ex larva tubicola' are *macrosignella*.

Chrétien (1917 : 473, 474) separated two species, *tamariciella* and *frankeniivorella*, based on different host-plants (*Tamarix* species and *Frankenia pallida* Boissier) as well as on certain differences in the colour of the larvae and the wing markings of the moths. I have examined the lectotype ♀ of *frankeniivorella* and a ♂ which Chrétien reared on *Tamarix*; both represent the same species. While the differences in the moths can be explained by the considerable variability of wing markings and colour in *heluanensis*, not enough is known about the larvae to account for their colour differences; however, considerable variation in colour has been observed in the larvae of *O. plutelliformis*.

Teleja [sic] *oasicolella* Turati was described from an unspecified number of specimens. The Turati collection contained one ♂ and one ♀. The ♀ bears the label '*oasicolella* H[olo] Type.', probably in Turati's handwriting. Although the colour photograph in the original publication is of poor quality, it seems certain that it illustrates this particular specimen, which is here designated as the lectotype. The ♂ bears (?) Turati's label '*oasicolella* All[o]-Type.' and has now been labelled as paralectotype.

Lita siculella Mariani was described from one specimen in coll. Mariani and one specimen in MNHU, Berlin. I was unable to obtain the specimen from Mariani's collection which is still in the hands of his family; however, the specimen from MNHU, Berlin, was available and is here designated as the lectotype. The specimen bears the label '*Lita siculella* Mariani', in Mariani's handwriting. Mariani stated that the species was collected in August. On the data label of the lectotype the printed 'VIII.' has been altered by hand to '23.IX.' and it seems likely that Mariani had sent this specimen to Berlin without recording the exact date for his publication.

BIOLOGY. Host-plants: *Frankenia pallida* Boissier (moth bred by Chrétien); *Frankenia* species (moth bred by Walsingham); *Tamarix tetragyna* Ehrenberg and *T. nilotica* (Ehrenberg) Bunge (moths bred by Debski); unspecified species of *Tamarix* (moths bred by Chrétien, Dumont, Gerling and Lupo).

As far as can be seen from the literature (Debski, 1913 : 111; Chrétien, 1917 : 473, 474) and information from data labels of specimens, the larva lives in a silken tunnel which is covered with the deciduous terminal shoots of *Tamarix* or other material. The larva feeds on the terminal shoots of *Tamarix* or mines the succulent leaves of *Frankenia* which then turn white. Pupation takes place in a cocoon on the ground.

The number of generations per year is unknown. There may be two clear-cut generations in southern Europe or Central Asia; however, there are indications that *heluanensis* breeds continuously under favourable conditions. In North Africa larvae have been observed by various collectors in April–June, November and December whereas moths have been collected in all months of the year.

DISTRIBUTION. Spain; Italy (Sicily); Malta; Yugoslavia; U.S.S.R. (S. Russia, Turkestan); Turkey; Cape Verde Islands (St. Vincent); Canary Islands (Gran Canaria); Morocco; Algeria; Tunisia; Libya; Egypt; Sudan; Israel; Syria; Saudi Arabia; Iraq; Iran; Afghanistan; Pakistan; Mongolia.

FURTHER MATERIAL EXAMINED.

SPAIN: 2 ♂, 15 ♀, Prov. Almeria, (Cabo de Gata) Mazarulleque, 3.viii.1968 (*Sattler & Carter*) (BMNH); 1 ♂, 8 ♀, Prov. Murcia, Alhama de Murcia, 19.–20.ix.1974 (*Glaser*) (coll. Glaser, Vienna; BMNH) [first record for Spain]. MALTA: 1 ♀, Gozo Xlendi, 3.ix.1956 (*de Lucca*) (coll. de Lucca, Malta); 1 ♀, Melleha, 9.ix.1956 (*de Lucca*) (coll. de Lucca, Malta) [first record for Malta]. TURKEY: 1 ♂, Esan river, 50 km E. of Fethiye, 20.viii.1972 (*Gerling*) (TAU, Tel-Aviv); 1 ♂, 50 km W. of Silifke, 17.viii.1972 (*Gerling*) (TAU, Tel-Aviv) [first record for Turkey]. CANARY ISLANDS: 3 ♂, 2 ♀, Gran Canaria, Maspalomas, 26.–27.ii.1967 (*Kasy*) (NM, Vienna; BMNH) [first record for the Canary Islands]. LIBYA: 1 ♂, Cyrenaica, Bengasi, 30.iv.1922 (*Krüger*) (IE, Bolzano) (paralectotype of *T. oasicolella* Turati). ISRAEL: 2 ♂, 4 ♀, Jiftlik Post, 35 km N. of Jericho, larvae in webs on *Tamarix*, 3.vi., moths emerged 4.vii.–15.viii.1971 (*Lupo*) (TAU, Tel-Aviv); 1 ♂, Nahal Ze'elim, 12 km S. of Ein Gedi, larva in web on *Tamarix*, 27.xii.1970, moth emerged 17.i.1971 (*Gerling*) (TAU, Tel-Aviv); 1 ♂, Ein-Feshcha, 22.ix.1971 (*Kugler*) (TAU, Tel-Aviv); 1 ♂, Nahal David, 26.ix.1971 (*Kugler*) (TAU, Tel-Aviv). AFGHANISTAN: 1 ♂, Ghorband Valley, N. of Kabul, 1900 m, 30.vii.1965 (*Kasy & Vartian*) (NM, Vienna). MONGOLIA: 3 ♂, 3 ♀, Bajanchongor aimak, oasis Echin gol, 90 km NE. of borderpost Caganbulag, 950 m, 27.–29.vi.1967 (*Kaszab*, no. 857) (TM, Budapest); 3 ♂, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest; BMNH); 1 ♀, South Gobi aimak, 10 km NNE. of Dalanzadgad, 1450 m, 7.vii.1967 (*Kaszab*, no. 898) (TM, Budapest) [first record for Mongolia].

Ornativalva longiductella Sattler, 1967

(Pl. 13, fig. 82)

Ornativalva longiductella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 40, pl. 3, fig. 17, pl. 9, fig. 46. Holotype ♀, ALGERIA: Hammam-es-Salahin, 15.iv.1904 (*Walsingham*) (genitalia slide no. 6563; BMNH) [examined].

Ornativalva longiductella Sattler, 1964 : 578. Nomen nudum.

GENITALIA ♂. Pl. 13, fig. 82.
GENITALIA ♀. Sattler, 1967, pl. 9, fig. 46.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in February–April, June, July and October.

DISTRIBUTION. Algeria; Tunisia; Sudan; Iraq; Afghanistan; Mongolia.

FURTHER MATERIAL EXAMINED.

MONGOLIA: 5 ♂, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest; BMNH); 1 ♂, Bajanchongor aimak, spring Talyn Bilgech Bulag, 47 km E. of borderpost Caganbulag, 1200 m, 23.vi.1967 (*Kaszab*, no. 840) (TM, Budapest); 3 ♂, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest; BMNH) [first record for Mongolia].

***Ornativalva rufipuncta* sp. n.**

(Pl. 2, fig. 16; Pl. 13, fig. 83; Pl. 21, fig. 106)

♂, ♀. 5·0–6·0 mm. Head without frontal modifications. Frons pale, whitish grey, scales on vertex mixed with brown. Labial palpus whitish, outer surface of second segment with brown band near base and before apex; third segment with broad brown band around middle, apex brown. Antenna brown with white rings above, white below. Thorax and tegula greyish, apex of tegula whitish. Fore wing greyish with red-brown markings. Two red-brown dots in cell, double dot at end of cell, short streak in fold at base; three red-brown dots on fold, at one-third, two-thirds and end of fold. Narrow red-brown zone along base of fringes. Outer transverse line sharply angulate in middle. Fringes whitish, divided by several grey lines.

GENITALIA ♂ (Pl. 13, fig. 83). Tegumen with deep anterior emargination, sclerotized part narrow. Costa as long as valva. Harpe short. Basal two-thirds of valva broad, distal third much narrower, curved, tapering, without apical spine. Basal third of aedeagus oval, apical two-thirds much narrower, strongly curved.

GENITALIA ♀ (Pl. 21, fig. 106). Apophysis posterior slightly longer than apophysis anterior.

Sclerotized antrum as long as apophysis anterior. Ductus bursae coiled, extended about three times length of abdomen. Corpus bursae small, globular. Signum long, irregular, sclerotized plate with pair of strong spines.

REMARKS. *O. rufipuncta* differs externally from all other *Ornativalva* species by the distinct red-brown fore wing markings. Similarities in the ♀ genitalia, particularly the extremely long ductus bursae, place *rufipuncta* near *longiductella*.

BIOLOGY. Host-plant unknown. The type-series was taken in association with other species known to feed on *Tamarix*. Moths have been collected at light in April.

DISTRIBUTION. S. Iran (Luristan).

MATERIAL EXAMINED.

Holotype ♂, IRAN: S. Iran, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 15.iv.1972 (*Exped. Mus. Vind.*) (NM, Vienna).

Paratypes. IRAN: 1 ♂, S. Iran, [Luristan,] 8 km E. of Bandar-Abbas, 23.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 6 ♂, 12 ♀, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 10., 15.iv.1972, 21.iv.–17.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 3 ♂, 1 ♀, [Luristan,] 22 km E. of Bandar-Abbas, 19. iv., 10.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 1 ♂, 3 ♀, [Luristan,] 30 km E. of Bandar-Abbas, 3.iv.1970, 8.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 3 ♀, [Luristan,] 13 km NE. of Bandar-Abbas, 6.iv.1972, 24.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 3 ♂, 2 ♀, [Luristan,] 22 km N. of Bandar-Abbas, 9.iv.1972, 18., 25.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 1 ♀, [Luristan,] 25 km S. of Minab, 4.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna).

Ornativalva roseosuffusella Sattler, 1967

Ornativalva roseosuffusella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 42, pl. 3, fig. 18, pl. 9, fig. 47. Holotype ♂, IRAN: W. Iran, Khuzistan, Shadegan, 1.–8.iii.1956 (*Richter*) (genitalia slide no. 298b, Sattler; SMN, Stuttgart) [examined].

GENITALIA ♂. Sattler, 1967, pl. 3, fig. 18.
GENITATIA ♀. Sattler, 1967, pl. 9, fig. 47.

BIOLOGY. Host-plant unknown. The type-specimens have been collected in March and April.

DISTRIBUTION. W. Iran (Khuzistan).

Ornativalva zonella (Chrétien, 1917)

Teleia zonella Chrétien, 1917, *Annls Soc. ent. Fr.* **85** : 474. Lectotype ♀, TUNISIA: Gafsa, larva on *Tamarix*, 21.vi., moth emerged 3.v.1909 (*Chrétien*) (genitalia slide no. 370c, Sattler; MNHN, Paris), designated by Sattler, 1967 : 88 [examined].
Gelechia zonella (Chrétien) Caradja, 1920 : 99.
Gelechia zonella (Chrétien); Meyrick, 1925*a* : 78.

Teleia cimelion Amsel, 1935*a*, *Veröff. dt. Kolon. u. Übersee-Mus. Bremen* **1** : 210, pl. 11, figs 14, 15. Type ♀, ISRAEL: south end of Dead Sea, 15.–27.iii.1933 (*Aigner*) (location of type unknown) [not examined]. **Syn. n.**

Gelechia cimelion (Amsel) Gaede, 1937 : 154.

Gelechia zonella (Chrétien); Gaede, 1937 : 231.

Ornativalva cimelion (Amsel) Sattler, 1960 : 59.

Ornativalva iranella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 44, pl. 3, fig. 19. Holotype ♂, IRAN: S. Iran, [Kerman,] Jiroft ('Djiroft'), Anbar-Abad, 21.–30.iv.1956 (*Richter*) (genitalia slide no. 297b, Sattler; SMN, Stuttgart) [examined]. **Syn. n.**

Ornativalva zonella zonella (Chrétien) Sattler, 1967 : 44, 88, pl. 1, fig. 6, pl. 3, fig. 20, pl. 9, fig. 48.

Ornativalva zonella cimelion (Amsel); Sattler, 1967 : 45, pl. 1, fig. 7, pl. 10, fig. 49.

GENITALIA ♂. Sattler, 1967, pl. 3, figs 19, 20.

GENITALIA ♀. Sattler, 1967, pl. 9, fig. 48, pl. 10, fig. 49.

REMARKS. The examination of fresh material and the previously studied specimens has led me to the conclusion that the separation of *cimelion* as a subspecies of *zonella* is not justified and that *iranella* is only a form of *zonella*.

T. cimelion was described from 'Typen und Cotypen, 3♀♀'. I have been unable to locate a specimen labelled 'Typus'; however, two 'Cotypus' ♀ have been examined.

BIOLOGY. Host-plant: *Tamarix* species (moths bred by Chrétien). According to Chrétien (1917 : 475) the larva lives in a small silken tube between two or three twigs of *Tamarix*. It is fully grown in November and pupates on the ground in a cocoon which is covered with particles of soil. For a description of the larva see Chrétien (loc. cit.). Moths have been taken by various collectors between March and June.

DISTRIBUTION. Algeria; Tunisia; Israel; Saudi Arabia; S. Iran (Kerman, Luristan).

FURTHER MATERIAL EXAMINED.

IRAN: 1 ♂, 1 ♀, S. Iran, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 10., 15.iv.1972 (*Exped. Mus. Vind.*) (NM, Vienna); 2 ♂, [Luristan,] 25 km S. of Minab, 4.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna).

THE *ERUBESCENS*-GROUP

(Text-fig. 4)

Head with or without enlarged scale bases and frontal process. Metascutum with paired group of narrow, hair-like scales (Text-fig. 2). Fore wing with or without basal streak on inner margin. Frenulum of ♀ triple. In ♂ genitalia uncus reduced; costa and valva present, harpe digitate or clavate, in *ignota* absent. Sacculus partially separated from valva. Anellus membranous or anellus lobes weakly sclerotized. In ♀ genitalia posterior margin of eighth tergite with irregular row of long setae. Apophysis anterior well developed, rod-like. Sclerotized antrum developed. Signum single or divided into two, with pair of strong spines or transverse tooth-like ridges.

BIOLOGY. Several species have been bred on *Tamarix*.

Ornativalva levifrons sp. n.

(Pl. 1, fig. 1; Pl. 2, fig. 17; Pl. 14, fig. 84; Pl. 21, fig. 107; Text-fig. 22)

♂, ♀. 6·0–7·0 mm. Head without enlarged scale bases or frontal process. Vertex pale, without dark longitudinal line. Labial palpus pale, outer surface of second segment dark brown near base, ochreous at apex; third segment light ochreous above, brown below. Thorax ochreous, laterally brown. Tegula brown with light apex. Anterior half of fore wing pale ochreous with brown markings. In fresh specimens lighter area suffused with pink. Posterior half of fore wing ochreous with short, dark brown basal streak, longer streak along basal half of fold, patch behind middle of fold and patch near end of cell.

GENITALIA ♂ (Pl. 14, fig. 84). Lateral margins of uncus parallel, posterior margin slightly rounded, with number of setae. Anterior margin of tegumen with deep square emargination. Harpe short, robust, densely set with setae. Sacculus reaches middle of valva. Basal third of aedeagus bulbous, apical two-thirds slender, strongly curved before apex.

GENITALIA ♀ (Pl. 21, fig. 107). Antrum large, funnel-shaped, anterior portion narrow. Ductus bursae three to four times length of apophysis posterior, wider than narrow anterior portion of antrum. Signum in posterior part of corpus bursae, near entrance of ductus bursae, composed of pair of weakly sclerotized basal plates with transverse ridge; basal plates connected by narrow sclerotized bridge. Posterior margin of seventh sternite with shallow median emargination (Text-fig. 22).

REMARKS. *O. levifrons* is closely related to *erubescens* and *lilyella*, differing from *erubescens* by the dark markings of the fore wing which are not strongly angulate at the fold, the short harpe, the shape of the aedeagus, the antrum and the signum with sclerotized bridge. *O. levifrons* differs from *lilyella* by the absence of a frontal process of the head, the presence of a dark basal streak on the fore wing, the short robust harpe, the long ductus bursae and the weaker signum with a narrower sclerotized bridge. *O. levifrons* differs from *arabica* by the presence of a light area between costa and fold on the fore wing. In the ♂ genitalia the uncus is shorter, the harpe more globular and the saccus narrower. The ♀ genitalia of *levifrons* are very similar to those of *arabica* but the tubular part of the antrum is narrower and the sclerotized bridge between both parts of the signum is very narrow; however, the width of the bridge is variable in *arabica*. The ♀ genitalia of *levifrons* are also very similar to those of *lilyella*, *aspera* and *pulchella*, all of which are distinguished externally by the frontal processes of the head. *O. levifrons* is the only Mongolian species of the *erubescens*-group without modified head structures.

BIOLOGY. Host-plant unknown. Moths have been taken by Kaszab between 23 June and 5 July.

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest).

Paratypes. MONGOLIA: 2 ♂, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest; BMNH); 1 ♂, Bajanchongor aimak, spring Talyn Bilgech bulag, 47 km E. of borderpost Cagan-bulag, 1200 m, 23.vi.1967 (*Kaszab*, no. 840) (TM, Budapest); 1 ♀, Bajanchongor aimak, oasis Dzun mod, 100 km S. of Somon Schine žinst, 1300 m, 29.vi.1967

(*Kaszab*, no. 869) (BMNH); 1 ♂, Chovd aimak, 10 km SSW. of Somon Bulgan, 1200 m, 5.vii.1966 (*Kaszab*, no. 633) (TM, Budapest).

Ornativalva erubescens (Walsingham, 1904)

(Pl. 5, figs 36–38; Text-fig. 4)

Gelechia erubescens Walsingham, 1904, *Entomologist's mon. Mag.* **40** : 265. Lectotype ♀ [not ♂ as stated by Walsingham], ALGERIA: Biskra, 11.iii.1903 (*Walsingham*) (genitalia slide no. 6145; BMNH), designated by Sattler (1967 : 47) [examined].
Gelechia erubescens Walsingham; Meyrick, 1925*a* : 79.
[*Gelechia plutelliformis* Staudinger; Amsel, 1935*b* : 263 (partim). Misidentification.]
Gelechia erubescens Walsingham; Gaede, 1937 : 171.
Ornativalva erubescens (Walsingham) Sattler, 1964 : 578.
Ornativalva erubescens (Walsingham); Amsel, 1966 : 128.
Ornativalva erubescens (Walsingham); Sattler, 1967 : 45, 47, pl. 1, fig. 8, pl. 4, figs 21a–c, 22, pl. 10, fig. 50.

Head (Pl. 5, figs 36–38) without enlarged scale bases or frontal process.
GENITALIA ♂. Sattler, 1967, pl. 4, figs 21a–c, 22.
GENITALIA ♀. Sattler, 1967, pl. 10, fig. 50.

REMARKS. The lectotype ♀ was erroneously recorded by Walsingham as 'type ♂' (no. 96 595). The 'type ♀' (no. 96 596) is not conspecific with the lectotype but belongs to *O. ignota*.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in January, May, August and November.

DISTRIBUTION. Morocco; Algeria; Tunisia; Libya; Egypt; Sudan; Israel; Saudi Arabia; Iran; Pakistan.

FURTHER MATERIAL EXAMINED.

PAKISTAN: 1 ♀, 150 km SW. of Quetta, 900 m, 13.v.1965 (*Kasy & Vartian*) (NM, Vienna) [first record for Pakistan].

Ornativalva lilyella (Lucas, 1944)

(Pl. 6, figs 39–41)

Gelechia lilyella Lucas, 1944, *Bull. Soc. ent. Fr.* **48** : 135. Holotype ♂, ALGERIA: El Goléa, 21.ii.1939 (*Lucas*) (genitalia slide no. 581a, Sattler; MNHN, Paris) [examined].
Ornativalva lilyella (Lucas) Sattler, 1967 : 48, pl. 4, fig. 21d, 23, pl. 10, fig. 51.

Head (Pl. 6, figs 39–41) with arc of irregularly arranged teeth above transfrontal sulcus. Short thick frontal process truncate, dorsally and laterally smooth, without teeth or scale bases, anterior surface densely set with teeth; some big teeth scattered in area below frontal process.

GENITALIA ♂. Sattler, 1967, pl. 4, figs 21d, 23.
GENITALIA ♀. Sattler, 1967, pl. 10, fig. 51.

REMARKS. The head structure resembles that of *aspera*; however, the frontal process has a wider diameter than that of *aspera* and the frons is not so densely set with teeth. The ♀ genitalia are very similar to those of *levifrons*, *aspera* and *pulchella*.

BIOLOGY. Host-plant unknown. Moths have been collected by Dumont and Lucas in February–April and October.

DISTRIBUTION. Algeria.

Ornativalva aspera sp. n.

(Pl. 1, fig. 2; Pl. 2, fig. 18; Pl. 6, figs 42–44; Pl. 14, fig. 85; Pl. 22, fig. 108)

♂, ♀. 5·0–6·5 mm. Head (Pl. 6, figs 42–44) with arc of irregular teeth above transfrontal sulcus. Frontal process short, truncate, dorsal surface smooth, without teeth or scale bases, frontal and ventral surfaces covered irregularly with enlarged scale bases. Frons pale, vertex light brown, dark brown around ocellus. Thorax light brown, along lateral margins dark brown. Tegula dark brown. Labial palpus whitish; outer surface of second segment light brown at base and before apex; third segment brown below. Antenna dark brown, above with light rings, whitish below. Fore wing with basal two-thirds of anterior half dark brown, in places lighter towards costa; posterior half light brown, with short dark basal streak. Dark brown area of wing angulate at fold, with whitish tooth extending deep into area between dark angles; in some places dark angles lined with white scales. Apical third of wing light brown, with dark shadow on costa near apex; whitish patch behind dark dot at end of cell. Base of fringes with indistinct dark line.

GENITALIA ♂ (Pl. 14, fig. 85). Lateral margins of uncus parallel. Anterior margin of tegumen with square emargination. Harpe digitate, about half length of costa. Apical half of valva curved, pointed, but not ending in distinct spine. Terminal quarter of sacculus free, not fused with valva; inner surface near middle with distinct projections which point towards costa. Dorsal margin of sacculus with long setae.

GENITALIA ♀ (Pl. 22, fig. 108). Antrum large, funnel-shaped, anterior portion narrow. Ductus bursae approximately twice length of apophysis posterior, half width of narrow anterior portion of antrum. Signum in posterior part of corpus bursae, near entrance of ductus bursae, composed of pair of weakly sclerotized basal plates with transverse ridge; basal plates connected by sclerotized bridge of moderate width.

REMARKS. *O. aspera* is closely related to *pulchella* but is slightly smaller, the frontal process of the head is slightly shorter and a distinct arc of irregular teeth is present above the transfrontal sulcus. In the fore wing *aspera* differs from *pulchella* by the short dark basal streak, the light brown area which does not extend to the apex, the whitish tooth between the angles of the dark anterior markings, and the more distinct black dot at the end of the cell. The ♂ genitalia differ from those of *pulchella* by the stronger, less curved, terminal portion of the valva and the sacculus which is widest near its middle. In the ♀ genitalia the setae with strongly curved tips on the posterior margin of the papilla analis are weaker and more numerous, the sclerotized part of the eighth tergite is narrower, the ductus bursae is shorter and narrower and the sclerotized bridge of the signum is wider than in *pulchella*. As only 1 ♀ of *pulchella* was available for examination it is impossible to decide which of these differences are of significance. The ♀ genitalia are also very similar to those of *levifrons* but differ by the shorter and narrower ductus bursae. *O. levifrons* is externally distinguished by the absence of frontal modifications of the head. *O. aspera* differs from the closely related *lilyella*, which is known only from Algeria, by the smaller size, the large number of teeth around the frontal process of the head, the basal streak and the distinct pattern of the fore wing, the longer, more digitate harpe, the sacculus and the shorter antrum.

BIOLOGY. Host-plant unknown. Moths have been collected by Kaszab between 22 June and 7 July in localities where *Tamarix* occurs (Kaszab, 1968 : 22, 31).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest).

Paratypes. MONGOLIA: 5 ♂, 3 ♀, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest; BMNH); 1 ♂, 1 ♀, South Gobi aimak, 10 km NNE. of the town Dalanzadgad, 1450 m, 7.vii.1967 (*Kaszab*, no. 898) (TM, Budapest; BMNH); 2 ♂, 4 ♀, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest; BMNH).

Ornativalva pulchella **sp. n.**

(Pl. 1, fig. 3; Pl. 2, fig. 19; Pl. 7, figs 45–47; Pl. 14, fig. 86; Pl. 22, fig. 109)

♂, ♀. 6·0–7·0 mm. Head (Pl. 7, figs 45–47) without distinct arc of irregular teeth above transfrontal sulcus. Frontal process truncate, smooth, frontal surface covered with teeth. Frontal area below transfrontal sulcus and frontal process slightly raised, covered with strong irregular teeth. Head pale ochreous, brown along eye. Thorax light brown, lateral margins dark brown. Tegula dark brown. Labial palpus whitish, outer surface of second segment with dark brown patch at base. Antenna dark brown with narrow light rings above, whitish below. Fore wing without basal streak. Anterior half of wing dark brown, markings angulate at fold, posterior half light brown up to apex. Small dark dot at end of cell, sometimes indistinct. Base of fringes with indistinct dark line.

GENITALIA ♂ (Pl. 14, fig. 86). Lateral margins of uncus parallel, posterior margin rounded, with setae. Anterior margin of tegumen with square emargination. Harpe slender, digitate. Apical portion of valva slender, strongly curved, apex with short spine. Sacculus triangular, with acute angle pointing towards base of valva; dorsal margin with long setae. Aedeagus with bulbous base, apical two-thirds curved, tapering.

GENITALIA ♀ (Pl. 22, fig. 109). Antrum funnel-shaped, ductus bursae approximately three times length of apophysis posterior, same width as narrow anterior portion of antrum. Signum in posterior part of corpus bursae, near entrance of ductus bursae, composed of pair of weakly sclerotized basal plates with transverse ridge; basal plates connected by very narrow sclerotized bridge.

REMARKS. *O. pulchella* is closely related to *aspera*; for differences see there. It is also closely related to the Algerian *lilyella* from which it differs by the darker colour and the more distinct markings of the fore wing, the more clearly defined frontal process of the head, the triangular sacculus, and the very narrow sclerotized bridge of the signum. The ♀ genitalia are very similar to those of *levifrons* but differ by the wider anterior portion of the antrum and the smaller signum. *O.*

levifrons is externally distinguished by the absence of frontal modifications of the head.

Biology. Host-plant unknown. The type-series has been collected by Kaszab on 22 June in a locality where *Tamarix* occurs (Kaszab, 1968 : 22).

Distribution. Mongolia.

Material examined.

Holotype ♂, Mongolia: South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (genitalia slide no. 635d, Sattler; TM, Budapest).

Paratypes. Mongolia: 2 ♂, 1 ♀, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest; BMNH).

Ornativalva ochraceofusca Sattler, 1967

(Pl. 1, fig. 5; Pl. 15, fig. 87; Pl. 22, fig. 110)

Ornativalva ochraceofusca Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 77, pl. 18, fig. 74.
Holotype ♂, Afghanistan: W. of Charikar (N. of Kabul), 1.viii.1963 (*Kasy & Vartian*) (genitalia slide no. 3277; NM, Vienna) [examined].

Head without enlarged scale bases or frontal process.

Genitalia ♂ (Pl. 15, fig. 87). Valva strongly bent at middle, narrow, distally nearly as wide as at separation point of sacculus.

Genitalia ♀ (Pl. 22, fig. 110). Apophysis posterior as long as eighth segment (including apophysis anterior). Short sclerotized antrum with longitudinal fold. Signum a narrow sclerotized plate with pair of long curved spines. Posterior margin of seventh segment with deep median emargination.

Remarks. *O. ochraceofusca* was previously placed tentatively in the *plutelliformis*-group (Sattler, 1967 : 78) but is here transferred to the *erubescens*-group. In the ♂ genitalia the length of the harpe and the shape of the sacculus were found to be variable. In the holotype from Afghanistan the distal half of the costa is club-shaped, while in Turkish specimens it is digitate. The ♀ genitalia are very similar to those of *ornatella*. In *ornatella* the eighth segment is laterally set with dense rows of microtrichia between the base of the apophysis anterior and the posterior margin of the segment. In *ochraceofusca* there is only a limited area set with very small microtrichia or they are completely absent. In *ornatella* the antrum appears to be longer than in *ochraceofusca* and the apophysis anterior is distally more clearly dilated. Externally *ornatella* is characterized by a clear basal streak on the fore wing, while *ochraceofusca* has some dark scales near the fore wing base without developing a clear basal streak. Although the ♂ genitalia are quite distinct there appears to be no reliable character for separating the ♀ genitalia of *ochraceofusca* and *ornatella*.

When examined earlier, the holotype bore only a temporary label, the data of which were cited in the original description (Sattler, 1967 : 78). The completed and corrected label data are cited above.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in June, July and August in association with other Lepidoptera species known to feed on *Tamarix*.

DISTRIBUTION. Turkey; Afghanistan.

FURTHER MATERIAL EXAMINED.

TURKEY: 5 ♂, 4 ♀, 10 km NW. of Gümüschane, 1000 m, 10.vi.1969 (*Kasy*; *Arenberger*) (NM, Vienna; coll. Arenberger, Vienna; BMNH); 3 ♂, 2 ♀, 40 km SW. of Elazig, 900 m, 18.vi.1969 (*Kasy*; *Arenberger*) (NM, Vienna; coll. Arenberger, Vienna; coll. Jäckh, Bidingen; BMNH) [first record for Turkey]. AFGHANISTAN: 3 ♀, Ghorband Valley, N. of Kabul, 1900 m, 30.vii.1965 (*Kasy & Vartian*) (NM, Vienna; BMNH).

Ornativalva species 1

(Pl. 15, fig. 88; Pl. 23, fig. 111; Text-fig. 23)

♂, ♀. 4·0–5·0 mm. Most of the moths are in poor condition. Head without enlarged scale bases or frontal process. Dark W-shaped markings of fore wing crossing fold at one-third and two-thirds. No basal streak. Distinct black dots in cell at distal end of W-markings and at end of cell.

GENITALIA ♂ (Pl. 15, fig. 88). Distal third of costa twice as wide as proximal two-thirds. Harpe slender. Valva straight, narrow. Sacculus triangular, widest at middle.

GENITALIA ♀ (Pl. 23, fig. 111). Eighth segment laterally with large zone of densely set microtrichia. Apophysis anterior half length of apophysis posterior, slightly dilated distally. Antrum short, funnel-shaped, half length of apophysis anterior. Anterior margin of eighth sternite with rounded projection near antrum. Signum pair of irregularly shaped medially fused sclerotized basal plates with sharp spine. Posterior margins of seventh tergite and sternite with deep median emargination (Text-fig. 23).

REMARKS. The ♂ genitalia differ from those of *ochraceofusca* by the valva which is straight, not strongly bent at middle, and the sacculus which is widest at middle, not in distal half. The ♀ genitalia differ from those of *ochraceofusca* by the dense area of microtrichia on the eighth segment, the longer antrum, the rounded anterior margin of the eighth sternite, the much weaker base of the signum, the strong signum spines and the distinct median emargination of the seventh sternite.

The fore wing base is light, without basal streak; in *ochraceofusca* it is dark, but no basal streak is separated; in *ornatella* a distinct basal streak is present.

BIOLOGY. Host-plant unknown. Moths have been collected by Kaszab in June in localities where *Tamarix* occurs (Kaszab, 1968 : 22, 23, 26–27).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

MONGOLIA: 1 ♂, South Gobi aimak, Zöölön ul, 58 km WSW. of Somon Bajandalaj, 1500 m, 16.vi.1967 (*Kaszab*, no. 807) (TM, Budapest); 2 ♂, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest; BMNH); 2 ♀, Bajanchongor aimak, spring Talyn Bilgech bulag, 47 km

E. of borderpost Caganbulag, 1200 m, 23.vi.1967 (*Kaszab*, no. 840) (TM, Budapest); 3 ♂, Bajanchongor aimak, oasis Echin gol, 90 km NE. of borderpost Caganbulag, 950 m, 27.–29.vi.1967 (*Kaszab*, nos 857, 858) (TM, Budapest); 1 ♂, 1 ♀, Bajanchongor aimak, oasis Dzun mod, 100 km S. of Somon Schine žinst, 1300 m, 29.vi.1967 (*Kaszab*, no. 869) (TM, Budapest; BMNH).

Ornativalva species 2

(Pl. 15, fig. 89)

Head without enlarged scale bases or frontal process.

GENITALIA ♂ (Pl. 15, fig. 89). Valva narrow, straight, distally rounded, narrowest at three-quarters. Sacculus narrow, not triangular.

GENITALIA ♀. Unknown.

REMARKS. Externally like species 1; differing in the genitalia by the distally dilated valva and the narrow sacculus.

BIOLOGY. Host-plant unknown. The moths have been collected by Kaszab in June in localities where *Tamarix* occurs (Kaszab, 1966 : 591; 1968 : 22).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

MONGOLIA: 1 ♂, Gobi Altaj aimak, Zachuj Gobi, 10 km N. of Chatan chajrchan mountains, 1150 m, 27.vi.1966 (*Kaszab*, no. 594) (TM, Budapest); 1 ♂, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest).

Ornativalva species 3

(Pl. 16, fig. 90)

Head without enlarged scale bases or frontal process.

GENITALIA ♂ (Pl. 16, fig. 90). Valva broad at base, not strongly bent, distal third narrow.

GENITALIA ♀. Unknown.

REMARKS. Like species 1 and 2 but slightly bigger, fore wing between fold and inner margin distinctly ochreous. In the ♂ genitalia the sacculus is similar to that of species 2 but the distal portion of the valva is not dilated.

BIOLOGY. Host-plant unknown. The only specimen has been collected by Kaszab in June.

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

MONGOLIA: 1 ♂, Bajanchongor aimak, Cagan Bogd ul, Tooroin bulag, 13 km E. of borderpost Caganbulag, 1500 m, 25.vi.1967 (*Kaszab*, no. 849) (TM, Budapest).

Ornativalva frontella **sp. n.**

(Pl. 1, fig. 4; Pl. 2, fig. 20; Pl. 7, figs 48–50; Pl. 16, fig. 91)

♂, ♀. 6·0–7·0 mm. Head (Pl. 7, figs 48–50) with dorsal surface of strongly curved arc above transfrontal sulcus almost completely free of scales. Vertex without enlarged scale bases. Strong frontal process below transfrontal sulcus truncate, anterior surface covered with enlarged scale bases. Frons below transfrontal sulcus with numerous enlarged scale bases arranged in irregular rings. Head pale ochreous, brown along eye. Labial palpus whitish, outer surface with scattered light brown scales; third segment brown, lighter above. Antenna dark brown with lighter rings; light below. Thorax light brown, laterally dark brown. Tegula dark brown. Light anterior and dark posterior half of fore wing divided by black longitudinal markings. Anterior half of wing suffused with pink, costa lined with brown scales. Black longitudinal markings lined anteriorly with white, separated by white patch in middle of cell. Markings gradually becoming lighter towards fold. Inner margin light brown up to fold, sometimes suffused with pink, with distinct dark basal streak.

GENITALIA ♂ (Pl. 16, fig. 91). Uncus short, tubular, posterior margin set with setae. Anterior margin of tegumen with deep angular emargination; sclerotized part of tegumen reduced to narrow frame. Costa slightly shorter than valva, distal third hardly wider than base, not clavate, densely set with short setae. Harpe approximately two-thirds length of costa, bent at right angle near middle. Basal half of valva broad, distal half narrow, curved, apex with short spine. Sacculus triangular, widest at base. Aedeagus with swollen base, tapering, apical third strongly curved. Manica partially sclerotized.

GENITALIA ♀. Unknown. The only available ♀ has lost its abdomen.

REMARKS. *O. frontella* differs from *aspera* and *pulchella* by the strongly developed arc above the transfrontal sulcus of the head, the light anterior half of the fore wing and the presence of a distinct basal streak. In the ♂ genitalia *frontella* differs by the bent harpe, the triangular sacculus which is widest at the base, the aedeagus with strongly curved apical portion and the sclerotized manica.

BIOLOGY. Host-plant unknown. Moths have been collected by Kaszab in June and July in localities where *Tamarix* occurs (Kaszab, 1966 : 591, 597; 1968 : 22).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (genitalia slide no. 637c, Sattler; TM, Budapest).

Paratypes. MONGOLIA: 1 ♀, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest) [abdomen missing]; 2 ♂, Gobi Altaj aimak, Zachuj Gobi, 10 km N. of Chatan chajrchan mountains, 1150 m, 27.vi.1966 (*Kaszab*, no. 594) (TM, Budapest; BMNH); 2 ♂, Chovd aimak, 10 km SSW. of Somon Bulgan, 1200 m, 5.vii.1966 (*Kaszab*, no. 633) (TM, Budapest; BMNH).

Ornativalva arabica Sattler, 1967

Ornativalva arabica Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 48, pl. 4, fig. 25 [not 24!], pl. 10, fig. 52. Holotype ♂, SAUDI ARABIA: Jeddah, 29.xii.1957 (*Diehl*) (genitalia slide no. 350a, Sattler; LN, Karlsruhe) [examined].

Head without enlarged scale bases or frontal process.

GENITALIA ♂. Sattler, 1967, pl. 4, fig. 25 [not 24!].
GENITALIA ♀. Sattler, 1967, pl. 10, fig. 52.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in February–April, August, November and December.

DISTRIBUTION. Sudan; Saudi Arabia.

FURTHER MATERIAL EXAMINED.

SAUDI ARABIA: 1 ♂, Mecca, 15.iii.1934 (*Philby*) (BMNH).

Ornativalva sesostrella (Rebel, 1912)

Gelechia sesostrella Rebel, 1912, *Dt. ent. Z. Iris* **26** : 88. Holotype ♀, EGYPT: Helwân, larva on *Tamarix*, moth emerged 15.–29.iv.1910 (*Debski*) (genitalia slide no. 3061; NM, Vienna) [examined].
Gelechia sesostrella Rebel; Meyrick, 1925*a* : 79.
Gelechia sesostrella Rebel; Gaede, 1937 : 212.
Ornativalva sesostrella (Rebel) Sattler, 1964 : 578.
Ornativalva sesostrella (Rebel); Sattler, 1967 : 50, pl. 4, fig. 24 [not 25!], pl. 11, fig. 53.

Head without enlarged scale bases or frontal process.
GENITALIA ♂. Sattler, 1967, pl. 4, fig. 24 [not 25!].
GENITALIA ♀. Sattler, 1967, pl. 11, fig. 53.

BIOLOGY. Host-plants: *Tamarix* species (moths bred by Debski and Kasy). Larvae have been collected by Kasy in January and February on *Tamarix* (?) *nilotica* (Ehrenberg) Bunge; the moths emerged in February. Moths have been taken by various collectors in January–August, October and November. It appears that *sesostrella* breeds continuously where conditions permit this. The larva was described by Debski on a specimen label as 'larva libera fusiformis'; no detailed description is available.

DISTRIBUTION. Algeria; Tunisia; Egypt; Sudan; Saudi Arabia; S. Iran (Kerman); Pakistan.

FURTHER MATERIAL EXAMINED.

IRAN: 1 ♂, S. Iran, [Kerman,] 80 km SE. of Sirjan, 9.iv.1970 (*Kasy*) (NM, Vienna) [first record for Iran]. PAKISTAN: 1 ♀, 80 km NW. of Quetta, 2100 m, 15.v.1965 (*Kasy & Vartian*) (NM, Vienna) [first record for Pakistan].

Ornativalva ignota Sattler, 1967

(Pl. 23, fig. 112)

Ornativalva ignota Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 52, pl. 4, fig. 26. Holotype ♂, ALGERIA: Hassi el Abiod, 29.ix.1918 (*Dumont*) (genitalia slide no. 376c, Sattler; MNHN, Paris) [examined].
[*Gelechia erubescens* Walsingham, 1904 : 265 (partim). Misidentification.]

Head without enlarged scale bases or frontal process.
GENITALIA ♂. Sattler, 1967, pl. 4, fig. 26.

GENITALIA ♀ (Pl. 23, fig. 112). Apophysis anterior half length of apophysis posterior. Sclerotized antrum slightly shorter than apophysis anterior. Signum pair of irregular basal plates with one straight slender spine each.

REMARKS. The ♀ genitalia of *ignota* are similar to those of *sesostrella* but differ by the much longer antrum.

Although the holotype and paratype are labelled 'Tunisie', their localities (Hassi el Abiod and Laghouat) are situated in Algeria.

BIOLOGY. Host-plant: *Tamarix* species (moth bred by Dumont). No information is available on the larva or larval habits. Moths have been bred or collected by Dumont and Walsingham in March, July and September.

DISTRIBUTION. Algeria.

FURTHER MATERIAL EXAMINED.

ALGERIA: 1 ♀, Biskra, 13.iii.1903 (*Walsingham*, no. 96 596) (genitalia slide no. 6267; BMNH) [paralectotype of *Gelechia erubescens* Walsingham].

THE *ORNATELLA*-GROUP

(Text-fig. 5)

Head without enlarged scale bases or frontal process. Metascutum with paired group of narrow hair-like scales (Text-fig. 2). Fore wing with basal streak on inner margin. Frenulum of ♀ triple. In ♂ genitalia costa, harpe, valva and sacculus present. Conspicuous lobe arising in angle between valva and sacculus. In ♀ genitalia posterior margin of eighth tergite with irregular row of long setae; eighth segment laterally set densely with rows of microtrichia. Antrum modified, with longitudinal folds. Signum with pair of strong spines; basal plates connected by wide sclerotized bridge.

BIOLOGY. Host-plant unknown. Moths have been collected in localities where *Tamarix* was observed or in association with other Lepidoptera species known to feed on *Tamarix*.

Ornativalva ornatella Sattler, 1967

(Pl. 16, fig. 92; Pl. 23, fig. 113; Text-figs 5, 13–17, 24)

Ornativalva ornatella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 78, pl. 2, fig. 12, pl. 7, fig. 39, pl. 14, fig. 65, pl. 16, fig. 70. Holotype ♂, AFGHANISTAN: Herat, 970 m, 5.v.1956 (*Amsel*) (genitalia slide no. 292a, Sattler; LN, Karlsruhe) [examined].

GENITALIA ♂ (Pl. 16, fig. 92; Text-figs 13, 14).

GENITALIA ♀ (Pl. 23, fig. 113; Text-figs 15–17, 24). Seventh segment modified, tergite and sternite medially emarginate; emargination of sternite much wider than that of tergite (Text-fig. 24).

REMARKS. In a ♂ from Rumania the anterior two-thirds of the fore wing up to the fold are almost entirely of a uniform grey, whereas the area between the fold and the inner margin is ochreous. In the ♀ paratype from Iran the anterior half of the fore wing is not as dark grey as in the Rumanian specimen and the ochreous area along the inner margin extends to the apex. The longitudinal streak which extends from the base along the posterior margin of the cell is distinct in the specimens from Iran, Afghanistan and Mongolia but is absent in the Rumanian specimen. The wings of a ♀ from Sarepta are too denuded of scales for an external comparison. The Sarepta specimen was originally identified by Christoph as *plutelliformis*. Walsingham (1908 : 939) recognized it as 'an allied species distinct from both [*plutelliformis* and *sieversi*]'.

In the ♂ genitalia of specimens from Mongolia the lobe that arises in the angle between valva and sacculus is straight, not curved, and is distally much wider than at the base (Text-fig. 13). In a ♂ from Rumania the harpe is much shorter than in specimens from Afghanistan and Mongolia and the lobe between valva and sacculus is distinctly larger than the free distal end of the sacculus (Text-fig. 14). In the ♀ genitalia of specimens from Mongolia the distal end of the apophysis anterior is wider than in specimens from Iran and Afghanistan (Text-figs 15, 16). In a ♀ from Sarepta the apophysis anterior is distally not dilated (Text-fig. 17).

BIOLOGY. Host-plant unknown. Most of the Mongolian specimens have been collected at light in localities where *Tamarix* occurs (Kaszab, 1968 : 23, 26, 27). Moths have been taken by various collectors in May–July, the Rumanian specimen in August.

DISTRIBUTION. Rumania; U.S.S.R. (S. Russia); Turkey; Iran; Afghanistan; Mongolia.

FURTHER MATERIAL EXAMINED.

RUMANIA: 1 ♂, [Dobrogea,] Sfintu Gheorghe, 15.viii.1971 (*Popescu-Gorj*) (MINGA, Bucharest) [first record for Rumania]. TURKEY: 1 ♀, Taurus, 20 km S. of Mut, 8.vii.1968 (*Arenberger*) (coll. Arenberger, Vienna) [first record for Turkey]. MONGOLIA: 1 ♂, 1 ♀, Bajanchongor aimak, spring Talyn Bilgech bulag, 47 km E. of borderpost Caganbulag, 1200 m, 23.vi.1967 (*Kaszab*, no. 840) (TM, Budapest); 2 ♀, Bajanchongor aimak, Cagan Bogd ul, Tooroin bulag, 13 km E. of borderpost Caganbulag, 1500 m, 25.vi.1967 (*Kaszab*, no. 849) (TM, Budapest); 2 ♂, 5 ♀, Bajanchongor aimak, oasis Echin gol, 90 km NE. of borderpost Caganbulag, 950 m, 27.–29.vi.1967 (*Kaszab*, nos 857, 858, 859) (TM, Budapest; BMNH); 8 ♂, 3 ♀, Bajanchongor aimak, oasis Dzun mod, 100 km S. of Somon Schine žinst, 1300 m, 29.vi.1967 (*Kaszab*, no. 869) (TM, Budapest; BMNH) [first record for Mongolia].

THE *PLICELLA*-GROUP

(Text-fig. 6)

Head without enlarged scale bases or frontal process. Metascutum with paired group of narrow hair-like scales. Fore wing without basal streak on inner margin. Frenulum of ♀ triple. In ♂ genitalia uncus reduced; costa, valva and harpe present. Sacculus separated from valva. Anellus lobes sclerotized. In ♀ genitalia posterior margin of eighth tergite with irregular row of long setae. Apophysis anterior rod-like, straight, or broad with bent distal third. Sclerotized antrum well developed or absent. Cervix bursae with one or two sclerotized transverse folds. Pair of rounded signa densely set with spines.

Biology. Host-plant unknown.

Ornativalva plicella sp. n.

(Pl. 2, fig. 21; Pl. 17, fig. 93; Pl. 24, fig. 114; Text-fig. 6)

♂, ♀. 6·0–7·0 mm. Head ochreous. Labial palpus pale ochreous, outer surface of second segment with scattered brown scales, particularly at base; third segment strongly mixed with brown scales. Antenna dark brown with indistinct paler rings above, whitish below. Thorax ochreous, laterally brown, with weak longitudinal brown line. Tegula brown, sometimes with light apex. Fore wing dark, grey-brown, between fold and inner margin ochreous, division line between dark and light area W-shaped at fold. Inner margin dark brown at base but no distinct basal streak separated. Indistinct black dot at end of cell. Indistinct light mark on costa at two-thirds, no distinct outer transverse line. Apex of wing ochreous, indistinct line of short dark streaks at base of fringes.

Genitalia ♂ (Pl. 17, fig. 93). Costa shorter than valva, slender, apical portion clavate. Harpe short, broad. Valva strongly curved at two-thirds, distal third narrow, apex rounded, without terminal spine. Sacculus two-thirds length of valva, narrow. Anellus lobes large, rounded. Aedeagus with big bulbous base and narrow apical half; apex rounded.

Genitalia ♀ (Pl. 24, fig. 114). Apophysis posterior as long as eighth segment (including apophysis anterior). Distal third of apophysis anterior conspicuously bent. No sclerotized antrum. Ductus bursae shorter than abdomen. Cervix bursae bears two sclerotized folds with serrated edges; folds connected by narrow sclerotization. Corpus bursae globular, with pair of irregularly rounded signa with strong spines.

Remarks. *O. plicella* differs from *undella* by the larger size, the darker colour of the fore wing and the ♀ genitalia with the strongly bent apophysis anterior, the two sclerotized folds of the cervix bursae and the absence of a sclerotized antrum.

Biology. Host-plant unknown. Moths have been collected by Kasy in April.

Distribution. S. Iran (Luristan).

Material examined.

Holotype ♂, Iran: S. Iran, [Luristan,] 100 km N. of Bandar-Abbas, 5.iv.1970 (*Exped. Mus. Vind.*) (genitalia slide no. 3877; NM, Vienna).

Paratypes. Iran: 2 ♂, 2 ♀, S. Iran, [Luristan,] 100 km N. of Bandar-Abbas, 5.iv.1970 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH).

Ornativalva undella sp. n.

(Pl. 1, fig. 15; Pl. 3, fig. 22; Pl. 24, fig. 115)

♀. 5·0 mm. Fore wing dark brown between costa and fold, ochreous between fold and inner margin, division line between dark and light area W-shaped at fold. Light area crosses fold near middle and extends to end of cell. Wing ochreous at apex and along outer margin. Light dot on costa at two-thirds; no outer transverse line. Fringes ochreous, basal half mixed with brown.

Genitalia ♂. Unknown.

Genitalia ♀ (Pl. 24, fig. 115). Apophysis posterior nearly three times length of apophysis anterior. Apophysis anterior straight. Antrum well developed, about twice length of apophysis anterior. Cervix bursae with sclerotized fold. Corpus bursae globular, with pair of irregularly rounded signa with strong spines.

Remarks. The holotype lacks the head which had to be reconstructed in the colour figure. The head structures are probably similar to those of *plicella*. *O. undella* differs from *plicella* by the smaller size, the lighter fore wing colour, the long antrum, the straight apophysis anterior and the presence of only one sclerotized fold in the cervix bursae.

Biology. Host-plant unknown. The only specimen has been collected by Kasy in May.

Distribution. SE. Iran (Baluchestan).

Material examined.

Holotype ♀, Iran: SE. Iran, [Baluchestan,] 100 km W. of Zahedan ('Sahidan'), 1150 m, 11.v.1965 (*Kasy & Vartian*) (genitalia slide no. 3864; NM, Vienna).

The *TAMARICIELLA*-Group

(Text-figs 7–9)

Head without enlarged scale bases or frontal process. Metascutum with paired group of narrow, hair-like scales (Text-fig. 2). Fore wing in some species with groups of raised scales, without (rarely with) basal streak on inner margin. Frenulum of ♀ triple. In ♂ genitalia uncus reduced; costa and valva present; harpe short, rounded or specialized (*pharaonis*). Sacculus partially separated from valva. Anellus lobes weakly sclerotized. In ♀ genitalia posterior margin of eighth tergite with irregular row of long setae. Apophysis anterior short, rod-like. Sclerotized antrum absent, posterior part of ductus bursae sometimes weakly sclerotized (*pharaonis*, *misma*) or with sclerotized ring at starting point of ductus seminalis (*macrosignella*). Signum of varied shape.

Biology. Several species have been bred from *Tamarix*.

Ornativalva species 4

(Pl. 25, fig. 116)

♀. 5·0–5·5 mm. Specimens poorly preserved.

Genitalia ♂. Unknown.

Genitalia ♀ (Pl. 25, fig. 116). Apophysis posterior as long as eighth segment (including apophysis anterior). Apophysis anterior short, wide at base, not rod-like, distally bent. No sclerotized antrum. Ductus bursae short and wide, gradually widening into corpus bursae. Sclerotized plate of signum elongate, medially constricted, with pair of transverse ridges.

Remarks. The signum appears somewhat similar to the signa of *lilyella* and *arabica*; however, the structure of the eighth abdominal segment, the short apophysis anterior and the absence of a sclerotized antrum place this species in the *tamariciella*-group.

BIOLOGY. Host-plant unknown. Moths have been collected by Kaszab in June and July in localities where *Tamarix* occurs (Kaszab, 1966 : 597–598; 1968 : 26–27).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

MONGOLIA: 1 ♀, Chovd aimak, 10 km SSW. of Somon Bulgan, 1200 m, 5.vii.1966 *Kaszab*, no. 633) (TM, Budapest); 1 ♀, Bajanchongor aimak, oasis Echin gol, 90 km NE. of borderpost Caganbulag, 950 m, 27.–29.vi.1967 (*Kaszab*, no. 857) (BMNH).

Ornativalva indica Sattler, 1967

(Text-fig. 8)

Ornativalva indica Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 54, pl. 5, fig. 27, pl. 11 fig. 54. Holotype ♂, INDIA: Bihar, Pusa, 29.iii.1930 (*Fletcher*) (genitalia slide no. 6509; BMNH) [examined].

[*Gelechia tamaricella* Zeller; Maxwell-Lefroy, 1909 : 534. Incorrect subsequent spelling of *tamariciella* Zeller. Misidentification.]

[*Gelechia tamariciella* Zeller; Fletcher, 1920 : 82 (partim). Misidentification.]

[*Gelechia tamariciella* Zeller; Meyrick, 1925*a* : 78 (partim). Misidentification.]

[*Gelechia tamariciella* Zeller; Fletcher, 1932 : 41. Misidentification.]

GENITALIA ♂. Sattler, 1967, pl. 5, fig. 27.
GENITALIA ♀. Sattler, 1967, pl. 11, fig. 54.

BIOLOGY. Host-plant: *Tamarix* species (moths bred by Fletcher). The host-plant is possibly *Tamarix indica* Willdenow. Fletcher (1920 : 82; 1932 : 42) erroneously identified it as *Tamarix gallica* Linnaeus, which does not occur in Pakistan and India.

According to the literature (Maxwell-Lefroy, 1909 : 82, Fletcher, 1920 : 82; 1932 : 41) the larva ties three or four twigs together into a case which it carries about. It feeds on dry twigs of *Tamarix*. Larvae have been observed in February, March, May and December. Pupation takes place in a cocoon on the ground. The pupal period lasts from 8 to 15 days. For a description of the larva and pupa see Fletcher (1920 : 82; 1932 : 42). Moths have been bred or collected in May–July.

DISTRIBUTION. S. Iran (Luristan); Pakistan (Peshawar); India (Bihar).

FURTHER MATERIAL EXAMINED.

IRAN: 1 ♂, 4 ♀, S. Iran, [Luristan,] 25 km S. of Minab, 4.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH) [first record for Iran].

Ornativalva pharaonis Sattler, 1967

Ornativalva pharaonis Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26**(3) : 58, pl. 2, fig. 10, pl. 5, fig. 28, pl. 17, fig. 73. Holotype ♂, SUDAN: Blue Nile Province, Wad Medani, 2.viii.1962 (*Remane*) (genitalia slide no. 19 859; BMNH) [examined].

GENITALIA ♂. Sattler, 1967, pl. 5, fig. 28.
GENITALIA ♀. Sattler, 1967, pl. 17, fig. 73.

BIOLOGY. Host-plant: *Tamarix* species (moths bred by Wiltshire and Trought); *Tamarix aphylla* (Linnaeus) Karsten (moths bred by Limon from larvae inhabiting the galls of *Eriophyes tlaiae* Trabut). Moths have been bred or taken by various collectors in March and June–November.

DISTRIBUTION. Tunisia; Libya; Egypt; Sudan; Israel.

FURTHER MATERIAL EXAMINED.

LIBYA: 1 ♀, Tripoli, larva on *Tamarix*, 22.xii.1960, moth emerged iii. 1961 (*Trought*) (BMNH) [first record for Libya]. ISRAEL: 1 ♂, 1 ♀, Ashkelon, larvae in galls of *Eriophyes tlaiae* Trabut on *Tamarix aphylla* (Linnaeus) Karsten, moths emerged 26., 27.x.1972 (*Limon*) (TAU, Tel-Aviv) [first record for Israel].

Ornativalva misma **sp. n.**

(Pl. 1, fig. 6; Pl. 3, fig. 23; Pl. 17, fig. 94; Pl. 25, fig. 117)

♂, ♀. 4·0 mm. Head pale ochreous, darker on vertex. Labial palpus whitish, outer surface of basal segment brown; outer surface of second segment with brown transverse bands at base and before apex; third segment with broad dark brown ring around middle and with dark apex. Antenna whitish below, above brown with paler rings. Thorax light brown, laterally dark brown. Tegula dark brown, apex light brown or whitish. Anterior two-thirds of fore wing pale ochreous with brown markings. Oblique brown band near base between costa and fold. Broader, more distinct band from basal third of costa to outer third of fold, darkest in fold; black dot at outer angle of band. Indistinct brown patches on costa at two-thirds and directly before apex. Black dot at end of cell. Posterior third of fore wing between fold and inner margin ochreous or light brown, without basal streak. Fringes light brown with dark brown base; outer dark band distinct below apex, fading towards tornus.

GENITALIA ♂ (Pl. 17, fig. 94). Costa clavate, approximately as long as sacculus, distinctly shorter than valva. Harpe short, rounded. Valva tapering, apex with short spine. Sacculus broad, fused with valva for most of its length. Saccus large. Aedeagus with bulbous base; apical two-thirds gently curved, tapering, apex pointed.

GENITALIA ♀ (Pl. 25, fig. 117). Apophysis anterior as long as eighth sternite. No sclerotized antrum. Posterior third of ductus bursae almost straight, weakly sclerotized; anterior two-thirds membranous, coiled. Corpus bursae with narrow band of minute spines across middle. Signum an elongate plate with pair of strong teeth.

REMARKS. *O. misma* is externally similar to *heluanensis* but the fore wing lacks the basal field which is often clearly separated in *heluanensis*. The fore wing fringes are fairly uniform in colour whereas in *heluanensis* they are usually disrupted by two or three light narrow longitudinal zones. The ♂ genitalia of *misma* are similar to those of *indica* but the apex of the costa is not conspicuously enlarged and the aedeagus has a longer and more pointed apex. Externally *indica* differs from *misma* by the presence of some groups of raised scales on the fore wing. The aedeagus of *misma* resembles that of *heligmatodes*; however, *heligmatodes* has a much narrower sacculus. In the ♀ genitalia the almost straight posterior portion of the ductus bursae resembles that of *pharaonis* but the signum and the longer apophysis anterior are distinct. *O. heligmatodes* with a similar signum has shorter apophyses anteriores and stronger signum teeth. In the only available ♀ of *misma* one signum tooth is much shorter than the other; however, this could be accidental.

BIOLOGY. Host-plant unknown. The type-specimens have been collected by Remane in June in association with other Lepidoptera species known to feed on *Tamarix*.

DISTRIBUTION. Sudan

MATERIAL EXAMINED.

Holotype ♂, SUDAN: NE. Sudan, Port Sudan, 23.vi.1962 (*Remane*) (genitalia slide no. 18 841; BMNH).

Paratype. SUDAN: 1 ♀, NE. Sudan, Port Sudan, 23.vi.1962 (*Remane*) (BMNH).

Ornativalva serratisignella Sattler, 1967

(Pl. 3, fig. 24; Pl. 17, fig. 95)

Ornativalva serratisignella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 60, pl. 12, fig. 59. Holotype ♀, IRAQ: Baghdad, Abu-Ghraib, 30.ix.1958 (*Remane*) (genitalia slide no. 19 858; BMNH) [examined].

Ornativalva serratisignella Sattler, 1964 : 578. Nomen nudum.

♂, ♀. 5·0–7·0 mm. Head grey. Labial palpus grey, outer surface of second segment with some brown scales near base and before apex; third segment with dark ring below middle, apex dark. Antenna brown with paler rings above, whitish below. Thorax and tegula grey. Fore wing grey, between fold and inner margin lighter than between costa and fold; with indistinct brown markings. W-shaped marking at fold, dark dot at end of cell. Dark shadow between end of cell and outer transverse line extending to tornus. Outer transverse line indistinct, strongly angulate. Incomplete dark line along termen. Fringes grey, on termen and tornus suffused with pink.

GENITALIA ♂ (Pl. 17, fig. 95). Costa as long as valva, apex densely set with strong setae. Harpe short, rounded. Valva with short apical spine. Sacculus well separated from valva, at one-third approximately three times as wide as before apex. Aedeagus with big bulbous base, apical portion straight.

GENITALIA ♀. Sattler, 1967, pl. 12, fig. 59.

REMARKS. As the type-material was in poor condition the above description of external characters is made from fresh specimens. Some specimens show an indication of raised scales on the fore wing, where the fold is crossed by the dark W-markings and in the tornus.

The specimen from Iranshahr, listed below, was available to me at the time of the original description; however, it was accidentally omitted from the type-series.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in February, April, May and September in association with other Lepidoptera species known to feed on *Tamarix*.

DISTRIBUTION. Sudan; Iraq; Iran (Luristan, Báluchestan).

FURTHER MATERIAL EXAMINED.

IRAN: 1 ♂, 3 ♀, S. Iran, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 15.iv.1972, 26.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 6 ♀, [Luristan,] 22 km E. of Bandar-Abbas, 19. iv., 10.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 3 ♂, 11 ♀, [Luristan,] 30 km E. of Bandar-Abbas, 8.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 2 ♂, [Luristan,] 13 km NE. of Bandar-Abbas, 24.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♂, 2 ♀, [Luristan,] 25 km S. of Minab, 4.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♀, [Baluchestan,] Iranshahr, 800 m, 22.–30.iv.1954 (*Richter & Schäuffele*) (SMN, Stuttgart) [first record for Iran].

Ornativalva caecigena (Meyrick, 1918)

(Pl. 1, fig. 7; Pl. 18, fig. 96)

Gelechia caecigena Meyrick, 1918, *Exot. Microlepidopt.* **2** : 134. Holotype ♀, PAKISTAN: Peshawar, [Tarnab,] v. 1916 (*Fletcher*) (genitalia slide no. 8251, Clarke; BMNH) [examined].
Telphusa caecigena (Meyrick) Meyrick, 1925*a* : 70.
Telphusa caecigena (Meyrick); Gaede, 1937 : 122.
Ornativalva caecigena (Meyrick) Sattler, 1967 : 67, pl. 15, figs 69, 69a.
Telphusa caecigena (Meyrick); Clarke, 1969 : 431, pl. 215, figs 2–2c.

GENITALIA ♂ (Pl. 18, fig. 96). Costa almost as long as valva, basal two-thirds with nearly parallel margins, terminal third gently tapering, apex rounded. Harpe short. Valva tapering, with short terminal spine. Sacculus narrow, distally dilated, near apex approximately twice as wide as near base. Aedeagus with bulbous base, angulate at middle, apex blunt.

GENITALIA ♀. Sattler, 1967, pl. 15, figs 69, 69a.

REMARKS. The ♂ genitalia are very similar to those of other species of the *tamariciella*-group but differ by the sacculus which is much wider near the apex than at the base. They are also distinguished by the blunt apex of the aedeagus.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in March–May.

DISTRIBUTION. Saudi Arabia; Kuwait; S. Iran (Luristan); Pakistan.

FURTHER MATERIAL EXAMINED.

SAUDI ARABIA: 1 ♀, Riad, 16.ii.1960 (*Diehl*) (LN, Karlsruhe) [first record for Saudi Arabia]. KUWAIT: 1 ♂, 10.iii.1944 (*Wiltshire*) (BMNH) [first record for Kuwait]. IRAN: 2 ♂, 1 ♀, S. Iran, [Luristan,] 8 km E. of Bandar-Abbas, dunes, 8., 11.iv.1972 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♂, 1 ♀, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 2., 15.iv.1972 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♀, [Luristan,] 22 km E. of Bandar-Abbas, 10.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♀, [Baluchestan,] Iranshahr, 800 m, 1.–10.iii.1954 (*Richter & Schäuffele*) (SMN, Stuttgart) [first record for Iran]. PAKISTAN: 2 ♀, 150 km SW. of Quetta, 900 m, 13.v.1965 (*Kasy & Vartian*) (NM, Vienna; BMNH).

Ornativalva macrosignella Sattler, 1967

Ornativalva macrosignella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 60, pl. 5, fig. 29, pl. 11, fig. 55. Holotype ♀, TUNISIA: Tozeur, vi. 1910 (*Lucas*) (genitalia slide no. 446b, Sattler; MNHN, Paris) [examined].
[*Teleia tamariciella* (Zeller); Rebel, 1912 : 90 (partim). Misidentification.]
[*Teleia tamariciella* (Zeller); Debski, 1913 : 110 (partim). Misidentification.]
[*Teteia heluanensis* Debski; Debski, 1913 : 111 (partim). Misidentification.]

[*Teleia tamaricalis* (Zeller); Amsel, 1933 : 125 (partim). Incorrect subsequent spelling of *tamariciella* Zeller. Misidentification.]
[*Teleia tamariciella* (Zeller); Amsel, 1935*b* : 263 (partim). Misidentification.]

GENITALIA ♂. Sattler, 1967, pl. 5, fig. 29.
GENITALIA ♀. Sattler, 1967, pl. 11, fig. 55.

BIOLOGY. Host-plants: *Tamarix tetragyna* Ehrenberg and *T. nilotica* (Ehrenberg) Bunge (moths bred by Debski). Larvae have been observed in April and December. Moths have been bred or taken by various collectors in February–July. As Debski (1913 : 111) was dealing with mixed material his description of the larva of '*heluanensis*' could apply to *macrosignella* (see also *heluanensis*, p. 102).

DISTRIBUTION. Algeria; Tunisia; Egypt; Sudan; Israel; S. Iran (Luristan).

FURTHER MATERIAL EXAMINED.

SUDAN: 2 ♂, 1 ♀, Ed Damer, Hudeiba, 1.–8.v.1962 (*Remane*) (ZSBS, Munich). IRAN: 2 ♂, S. Iran, [Luristan,] 30 km E. of Bandar-Abbas, 8.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna) [first record for Iran].

Ornativalva heligmatodes (Walsingham, 1904)

Gelechia heligmatodes Walsingham, 1904, *Entomologist's mon. Mag.* **40** : 267. LECTOTYPE ♂, ALGERIA: El Kantara, 25.v.1903 (*Walsingham*) (BMNH), here designated [examined].
Teleia heligmatodes (Walsingham); Caradja, 1920 : 104.
Gelechia heligmatodes Walsingham; Meyrick, 1925*a* : 78.
Gelechia heligmatodes Walsingham; Gaede, 1937 : 177.
Ornativalva heligmatodes (Walsingham) Sattler, 1960 : 59.
Ornativalva heligmatodes (Walsingham); Sattler, 1967 : 62, pl. 5, fig. 30, pl. 12, fig. 56.

GENITALIA ♂. Sattler, 1967, pl. 5, fig. 30.
GENITALIA ♀. Sattler, 1967, pl. 12, fig. 56.

REMARKS. Walsingham described *heligmatodes* from four specimens, including 'type, ♂ (96 465); ♀ (89 225)'. The specimen bearing Walsingham's number 96 465 and referred to as the 'type ♂' on the specimen label and in the original description is here designated as the lectotype.

Caradja (1920 : 104) erroneously considered *heligmatodes* to be a desert form of *tamariciella*. Rebel (1907 : 93; 1931 : 123), followed by Meyrick (1925*a* : 78), recorded *heligmatodes* from Socotra; however, his material proved to be *antipyramis*.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in March–June and August.

DISTRIBUTION. Algeria; Tunisia.

Ornativalva species 5

(Pl. 18, fig. 97; Pl. 25, fig. 118)

♂, ♀. 4·5–5·0 mm. Head pale ochreous. Labial palpus whitish, outer surface of second segment with brown scales, particularly at base and before apex; third segment with irregular brown ring around middle and brown apex. Thorax and tegula pale ochreous with scattered brown scales. Costal half of fore wing pale ochreous to grey. Light patch on costa before apex. Outer transverse line indistinct. W-shaped markings dark at fold. Black dots in middle and at end of cell. Posterior half of wing ochreous between fold and inner margin. Some dark scales on inner margin at base of wing, but no distinct basal streak.

GENITALIA ♂ (Pl. 18, fig. 97). Costa almost as long as valva, truncate, terminally almost twice as wide as basally. Harpe short, rounded. Apical portion of valva slender, with terminal spine. Sacculus shorter than costa and valva. Aedeagus with bulbous base; apical half straight, with parallel sides, not pointed.

GENITALIA ♀ (Pl. 25, fig. 118). Apophysis anterior half length of apophysis posterior. Narrow sclerotized plate below ostium bursae. No sclerotized antrum. Posterior portion of ductus bursae with zone of minute spines near junction of ductus seminalis. Signum a curved basal plate with pair of strong processes.

REMARKS. The ♂ genitalia resemble those of *macrosignella*, particularly the aedeagus; they differ by the slender apical portion of the valva. The ♀ genitalia are near those of *heligmatodes*, but differ by the signum. *O. heligmatodes* is also distinguished externally by the basal streak on the fore wing.

BIOLOGY. Host-plant unknown. Moths have been collected by Kasy in April and May in localities where *Tamarix* occurs.

DISTRIBUTION. S. Iran.

MATERIAL EXAMINED.

IRAN: 1 ♂, 5 ♀, S. Iran, [Luristan,] 22 km N. of Bandar-Abbas, 18., 22.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 1 ♀, [Baluchestan,] 100 km W. of Zahedan ('Sahidan'), 11.v.1965 (*Kasy & Vartian*) (NM, Vienna).

Ornativalva tamariciella (Zeller, 1850)

(Text-fig. 7)

Gelechia tamariciella Zeller, 1850, *Stettin. ent. Ztg* **11** : 153. Lectotype ♀, ITALY: Livorno, v. 1846 (*Mann*) (genitalia slide no. 6061; BMNH), designated by Sattler (1967 : 88) [examined].
Gelechia tamariciella Zeller; Herrich-Schäffer, 1854 : 167, pl. 75, fig. 567.
Gelechia tamariciella Zeller; Wocke, 1861 : 114.
Gelechia tamariciella Zeller; Stainton, 1867 : 20.
Gelechia tamariciella Zeller; Stainton, 1869 : 80.
Teleia tamariciella (Zeller); Wocke, 1871 : 295.
Telcia tamariciella (Zeller); Mann, 1873 : 128. Incorrect subsequent spelling of *Teleia* Heinemann.
Teleja tamariciella (Zeller); Curò & Turati, 1882 : 43. Incorrect subsequent spelling of *Teleia* Heinemann.
Teleia tamariciella (Zeller); Constant, 1892 : 67 (partim).
Teleia tamariciella (Zeller); Rebel, 1901 : 150 (partim).
Gelechia tamariciella Zeller; Meyrick, 1925*a* : 78 (partim).
Gelechia tamariciella Zeller; Gaede, 1937 : 217 (partim).
Ornativalva tamariciella (Zeller) Sattler, 1960 : 59.
Ornativalva tamariciella (Zeller); Sattler, 1967 : 63, 88, pl. 6, fig. 31, pl. 12, fig. 57.
Ornativalva tamariciella (Zeller); Zocchi, 1971 : 60, fig. vii.

GENITALIA ♂. Sattler, 1967, pl. 6, fig. 31.
GENITALIA ♀. Sattler, 1967, pl. 12, fig. 57.

REMARKS. The name *tamariciella* has been erroneously attributed to Mann by various authors. Although the name originated from Mann it was made nomenclaturally available by Zeller.

Between 1850 and 1967 the name *tamariciella* was recorded in approximately 40 publications. All of those records were either based directly or indirectly on the specimens which Mann collected in 1846 and 1872 or they were misidentifications.

Several authors have erroneously recorded *tamariciella* from Portugal, Spain, France, Malta, Algeria, Tunisia, Egypt, Israel, Saudi Arabia, Iran and India. Re-examination of most of the material on which those records were based has revealed the following misidentifications: Portugal, Spain, France – *pseudotamariciella*; Malta, Algeria, Iran – *heluanensis*; Egypt, Israel – *heluanensis*, *macrosignella*; India – *indica*. Records for 'Syria' are directly or indirectly attributable to Kalchberg (1898 : 190), who recorded *tamariciella* from Haifa [Israel]. Kalchberg's specimens have not been traced. The records for Tunisia and Saudi Arabia could not be checked but probably apply to *heluanensis*. Records for S. Italy and Sicily are doubtful and must be checked. The record for Piemonte (Mariani, 1943 : 166) might apply to *tamariciella* or *pseudotamariciella*.

BIOLOGY. Host-plants: *Tamarix* species (moths bred by Amsel); *T. gallica* Linnaeus (Zocchi, 1971 : 61).

Nothing is known about the larva and its habits. Mann observed the moths in May 1846; they were uncommon on *Tamarix* trees, flying before and after sunset when mating also took place (Zeller, 1850 : 153). Moths have been bred by Amsel in June 1930.

DISTRIBUTION. Italy (Toscana); Yugoslavia (Dalmatia).

Ornativalva pseudotamariciella Sattler, 1967

Ornativalva pseudotamariciella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 65, pl. 6, fig. 32, pl. 12, fig. 58. Holotype ♀, FRANCE: Alpes-Maritimes (? *Constant*) (genitalia slide no. 364; ZSBS, Munich) [examined].

[*Teleia tamariciella* (Zeller); Millière, 1876*a* : 330. Misidentification.]

[*Teleia tamariciella* (Zeller); Stainton, 1881 : 247. Misidentification.]

[*Teleia tamariciella* (Zeller); Constant, 1892 : 67. Misidentification.]

Ornativalva pseudotamariciella Sattler; Agenjo, 1968 : [5].

GENITALIA ♂. Sattler, 1967, pl. 6, fig. 32.
GENITALIA ♀. Sattler, 1967, pl. 12, fig. 58.

REMARKS. All records of *tamariciella* from Spain and S. France are probably referable to *pseudotamariciella*.

BIOLOGY. Host-plants: *Tamarix* species (moth bred by Constant); *T. gallica* Linnaeus (Millière, 1876*a* : 330); *T. africana* Poiret (Constant, 1892 : 67).

According to Millière (1876*a* : 330) the larva feeds in June and again in September on the leaves and flowers of its host-plant. Moths have been bred or taken by various collectors in May–July and September.

DISTRIBUTION. Portugal (Algarve); Spain (Cataluña, Murcia, Andalucía); France (Loire-Atlantique, Alpes-Maritimes).

FURTHER MATERIAL EXAMINED.

PORTUGAL: 1 ♂, Algarve, 17.v.1880 (*Eaton*) (BMNH) [first record for Portugal]. SPAIN: 1 ♂, Cataluña, Rosas, salt marshes, 20 m, 14.vi.1964 (*Glaser*) (coll. Glaser, Vienna); 1 ♀, Prov. Murcia, Alhama de Murcia, 19.–20.ix.1974 (*Glaser*) (coll. Glaser, Vienna).

Ornativalva kalahariensis (Janse, 1960)

(Text-figs 9, 18–20)

Pelostola kalahariensis Janse, 1960, *Moths S. Afr.* **6** : 189, pl. 78, fig. e, pl. 98, fig. b, pl. 99, figs, pl. 116, fig. f, pl. 117, figs f, h, i. Holotype ♂, SOUTH AFRICA: SW. Kalahari, Auob, iv. 1933 (*van Son*) (genitalia slide no. 5800, Janse; TM, Pretoria) [examined].
Stegasta species; Janse, 1949, pl. 31, fig. 1.
Ornativalva kalahariensis (Janse) Sattler, 1967 : 67, pl. 16, fig. 71, pl. 18, fig. 75.

GENITALIA ♂ (Text-figs 18–20). Sattler, 1967, pl. 18, fig. 75.
GENITALIA ♀. Sattler, 1967, pl. 16, fig. 71.

REMARKS. The genitalia of the holotype ♂ were illustrated by Janse (1960, pl. 78, fig. e) and Sattler (1967, pl. 18, fig. 75, erroneously marked as paratype). Some variation is found in the ♂ genitalia, particularly in the shape of costa and sacculus. In the holotype ♂ the right valva (Text-fig. 19) is wider than the left (Text-fig. 18), although part of the apparent difference may be due to the different position in the slide.

BIOLOGY. Host-plant unknown. The specimens collected by the BMNH Southern African Expedition were all taken in localities where *Tamarix usneoides* E. Meyer ex Bunge occurs (records of members of the expedition). Moths have been collected in January (BMNH Sth. Afr. Exped.), April and November (G. van Son).

DISTRIBUTION. South Africa; South West Africa.

FURTHER MATERIAL EXAMINED.

SOUTH WEST AFRICA: 5 ♂, 3 ♀, Homeb, 10 mls ESE. Gobabeb, at light, 23.–25.i.1972 (*BMNH Sth. Afr. Exped.*, no. 23) (BMNH); 3 ♂, Swakopmund, at light, 26.–30.i.1972 (*BMNH Sth. Afr. Exped.*, no. 25) (BMNH); 6 ♂, Kahn River, 5 mls N. Usakos, at light, 30.–31.i.1972 (*BMNH Sth. Afr. Exped.*, no. 29) (BMNH) [first record for South West Africa].

THE *PLUTELLIFORMIS*-GROUP

(Pl. 5, figs 33–35; Text-fig. 10)

Head without enlarged scale bases or frontal process. Metascutum with paired group of narrow, hair-like scales (Text-fig. 2). Fore wing with or without basal streak on inner margin. Frenulum of ♀ triple. In ♂ genitalia uncus reduced; costa, valva and harpe present. Sacculus long, narrow, separated from valva. Anellus lobes weakly sclerotized. In ♀ genitalia posterior margin of eighth tergite with irregular row of long setae. Apophysis posterior short. Sclerotized antrum short. Signum with pair of strong spines or transverse tooth-like ridges, single or divided into two parts.

BIOLOGY. Several species have been bred on *Tamarix*.

Ornativalva triangulella Sattler, 1967

Ornativalva triangulella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 68, pl. 6, fig. 33, pl. 13, figs 60, 60a. Holotype ♀, ALGERIA: Biskra, 6.iv.1907 (*Chrétien*) (genitalia slide no. 390c, Sattler; MNHN, Paris) [examined].

[*Gelechia plutelliformis* Staudinger; Amsel, 1955*b* : 126. Misidentification.]

GENITALIA ♂. Sattler, 1967, pl. 6, fig. 33.
GENITALIA ♀. Sattler, 1967, pl. 13, figs 60, 60a.

REMARKS. The holotype ♀ from the Chrétien coll. was labelled '*plutellif.* ? v. *auctella*' in Chrétien's handwriting. The name *auctella* is a nomen nudum. It originated from Chrétien and was introduced into the literature by Turati (1927 : 338) without becoming nomenclaturally available. Specimens in coll. Turati under the name *auctella* are *antipyramis* and *plutelliformis*.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in March–May and October.

DISTRIBUTION. Algeria; Tunisia; Kuwait; Iraq; SE. Iran (Baluchestan); Afghanistan.

FURTHER MATERIAL EXAMINED.

KUWAIT: 1 ♀, 30.iv.1943 (*Wiltshire*) (BMNH) [first record for Kuwait]. IRAN: 1 ♂, SE. Iran, [Baluchestan,] 100 km W. of Zahedan ('Sahidan'), 1150 m, 11.v.1965 (*Kasy & Vartian*) (BMNH) [first record for Iran].

Ornativalva antipyramis (Meyrick, 1925)

Gelechia antipyramis Meyrick, 1925*b*, *Bull. Soc. ent. Egypte* **9** : 209. Lectotype ♂, EGYPT: Ballah, vii. 1916 (*Buxton*) (genitalia slide no. 6144; BMNH), designated by Sattler (1967 : 87) [examined].
[*Teleia heligmatodes* (Walsingham) Rebel, 1907 : 93. Misidentification.]
[*Gelechia heligmatodes* Walsingham; Meyrick, 1925*a* : 78 (partim). Misidentification.]
[*Teleja haligmatodes auctella* Turati, 1927 : 338 (partim). Nomen nudum. Incorrect subsequent spellings of *Teleia* Heinemann and *heligmatodes* Walsingham. Misidentification.]
[*Teleia heligmatodes* (Walsingham); Rebel, 1931 : 123. Misidentification.]
Gelechia antipyramis Meyrick; Gaede, 1937 : 147.
[*Gelechia lacertella* Walsingham; Amsel, 1958 : 80, text-fig. 11. Misidentification.]
Ornativalva antipyramis (Meyrick) Sattler, 1964 : 578.
Ornativalva antipyramis (Meyrick); Amsel, 1966 : 128.
Ornativalva antipyramis (Meyrick); Sattler, 1967 : 70, 87, pl. 6, fig. 34, pl. 13, fig. 61.
Ornativalva antipyramis (Meyrick); Amsel, 1968 : 17.

GENITALIA ♂. Sattler, 1967, pl. 6, fig. 34.
GENITALIA ♀. Sattler, 1967, pl. 13, fig. 61.

REMARKS. The name *auctella* (nomen nudum) originated from Chrétien. Turati (1927 : 338) recorded four specimens, Cyrenaica: Giarabub, vii. 1926 (*Krüger*), which according to him agreed with a specimen from Biskra, identified as *auctella* by Chrétien. Two of those specimens, though not the one from Biskra, are now preserved in coll. Turati (IE, Bolzano). A ♂ without hind wings and abdomen is clearly *plutelliformis*, whereas a ♀ without abdomen is *antipyramis*; an '*auctella*' specimen in coll. Chrétien is *triangulella*.

BIOLOGY. Host-plant: *Tamarix* species. A ♀ (locality and collector unknown) in MNHN, Paris, is labelled '*Tamarix*, x.–xi.1908, écl. 13.v.1909'. Moths have been taken by various collectors in February–July and October.

DISTRIBUTION. Cape Verde Islands (St Vincent); Canary Islands (Gran Canaria); Morocco; Algeria; Tunisia; Libya; Egypt; Sudan; Socotra; Jordan; Saudi Arabia; United Arab Emirates; S. Iran (Luristan); Pakistan.

FURTHER MATERIAL EXAMINED.

LIBYA: 1 ♀, Cyrenaica, vii. 1926 (*Krüger*) (IE, Bolzano). JORDAN: 1 ♂, Azraq ed Druz, pumping station, 22.iv.–9.v.1966 (*Fletcher*) (BMNH); 5 ♂, 4 ♀, Wadi er Ratam, 24.iv.–10.v.1966 (*Fletcher*) (BMNH) [first record for Jordan]. UNITED ARAB EMIRATES: 1 ♀, Masafi, 22.–24.ii.1971 (*Gallagher*) (BMNH) [first record for United Arab Emirates]. IRAN: 1 ♀, S. Iran, [Luristan,] 8 km E. of Bandar-Abbas, 23.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 7 ♂, 9 ♀, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 2.–15.iv.1972, 21.iv.–17.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 1 ♂, 1 ♀, [Luristan,] 22 km E. of Bandar-Abbas, 19.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 4 ♂, 6 ♀, [Luristan,] 30 km E. of Bandar-Abbas, 3.iv.1970, 8.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 2 ♀, [Luristan,] 22 km N. of Bandar-Abbas, 4., 14.iv.1972 (*Exped. Mus. Vind.*) (NM, Vienna); 2 ♂, [Luristan,] 25 km S. of Minab, 4.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna) [first record for Iran].

Ornativalva singula Sattler, 1967

(Pl. 3, fig. 25; Pl. 18, fig. 98; Pl. 26, fig. 119; Text-figs 21, 25)

Ornativalva singula Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 71, pl. 7, fig. 35. Holotype ♂, AFGHANISTAN: Herat, 970 m, 5.v.1956 (*Amsel*) (genitalia slide no. 352a, Sattler; LN, Karlsruhe) [examined].

GENITALIA ♂ (Pl. 18, fig. 98; Text-fig. 21).

GENITALIA ♀ (Pl. 26, fig. 119; Text-fig. 25). Posterior margin of seventh sternite with pair of projections (Text-fig. 25). Sternopleural region of eighth segment with pair of minutely spined longitudinal folds. Apophyses anteriores short, bases connected by narrow sclerotization along anterior margin of eighth sternite. Sclerotized antrum very short, tubular. Ductus bursae coiled, approximately three times length of apophysis posterior. Corpus bursae globular. Signum with pair of strong spines; basal plates weakly sclerotized, connected by weakly sclerotized bridge.

REMARKS. In the ♂ genitalia of specimens from Mongolia the harpe is more digitate than in the holotype from Afghanistan (Text-fig. 21). The ♀ genitalia differ from those of other species by the pair of posterior processes on the seventh sternite (Text-fig. 25) and the pair of spined folds on the eighth sternite.

BIOLOGY. Host-plant unknown. The Mongolian specimens have been collected at light in localities where *Tamarix* occurs (Kaszab, 1968 : 22, 23). Moths have been collected by Amsel and Kaszab in May and June.

DISTRIBUTION. Afghanistan; Mongolia.

FURTHER MATERIAL EXAMINED.

MONGOLIA: 10 ♂, 10 ♀, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest; BMNH); 2 ♂, 4 ♀, Bajanchongor aimak, spring Talyn Bilgech bulag, 47 km E. of borderpost Caganbulag, 1200 m, 23.vi.1967 (*Kaszab*, no. 840) (TM, Budapest) [first record for Mongolia].

***Ornativalva basistriga* sp. n.**

(Pl. 1, fig. 8; Pl. 3, figs 26, 27; Pl. 19, fig. 99; Pl. 26, fig. 120)

♂, ♀. 6·5–8·0 mm. Head grey. Labial palpus grey, outer surface of second segment mixed with brown scales; basal half and apex of third segment brown. Thorax grey. Fore wing grey, between fold and inner margin ochreous, lighter grey along costa. W-shaped markings darkest along fold. Dark dot at end of cell with short dark streak which extends towards apex. Base of fringes with dark markings, particularly distinct along termen. Distinct dark basal streak on inner margin.

GENITALIA ♂ (Pl. 19, fig. 99). Costa slender, clavate, as long as sacculus, distinctly shorter than valva. Harpe slender, clavate, reaching dilated apical portion of costa. Valva long, distal half narrow with parallel margins, apex with short spine. Sacculus narrow, distally dilated. Aedeagus with bulbous base, apical two-thirds slender, curved, pointed.

GENITALIA ♀ (Pl. 26, fig. 120). Apophyses anteriores distally somewhat dilated, bases connected by narrow sclerotization along anterior margin of eighth sternite. No sclerotized antrum. Ductus bursae narrow, coiled, approximately twice length of apophysis posterior. Signum with pair of strong teeth; basal plates connected by indistinct, weakly sclerotized bridge.

REMARKS. An albinistic ♀ (Pl. 3, fig. 27) is almost completely white with only a few dark markings along the fold, between the end of the cell and the apex, on the base of the fringes on apex and termen, and on the inner margin near the base.

Externally *basistriga* is similar to *plutelliformis* and *grisea* but differs by the distinct basal streak on the inner margin of the fore wing. *O. singula*, which also has a basal streak, is much smaller. The ♂ genitalia of *basistriga* differ from those of all other species of the *plutelliformis*-group by the distally dilated sacculus. The ♀ genitalia differ from those of *singula*, *plutelliformis* and *sieversi* by the strong teeth – not spines – of the signum. The similar signum of *grisea* is divided, whereas in *basistriga* the basal plates are connected by a sclerotized bridge. However, as the sclerotization is indistinct and weak, it is possible that in a larger material *basistriga* specimens with two separate signa will be found. Equally, *grisea* specimens with a sclerotized bridge between the basal plates of the signum may be expected.

BIOLOGY. Host-plant unknown. Most of the type-specimens have been collected at light in localities where *Tamarix* occurs (Kaszab, 1966 : 597; 1968 : 18, 22, 31). Moths have been collected by Kaszab in June and July.

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: Chovd aimak, 10 km SSW. of Somon Bulgan, 1200 m, 5.vii.1966 (*Kaszab*, no. 633) (TM, Budapest).

Paratypes. MONGOLIA: 1 ♂, 1 ♀, Chovd aimak, 10 km SSW. of Somon Bulgan, 1200 m, 4.–6., 5.vii.1966 (*Kaszab*, nos 632, 633) (TM, Budapest; BMNH); 1 ♀, South Gobi aimak, SW. edge of salt lake Dund gol ('old' Somon Gurban-tes), 1300 m, 18.vi.1967 (*Kaszab*, no. 817) (TM, Budapest); 1 ♂, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest); 1 ♀, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967(*Kaszab*, no. 882) (BMNH).

Ornativalva plutelliformis (Staudinger, 1859)

(Pl. 5, figs 33–35; Text-fig. 10)

Gelechia plutelliformis Staudinger, 1859, *Stettin. ent. Ztg* **20** : 239. Lectotype ♀, SPAIN: Cadiz, Chiclana, bred on *Tamarix*, 25.vi.1858 (*Staudinger*) (genitalia slide no. 155b, Sattler; MNHU, Berlin), designated by Sattler (1967 : 88) [examined].

Alucita olbiaella Millière, 1861, *Iconogr. Descr. Chenilles Lépid. inédits* **1** : 193, 218, (liv. 4) pl. 1, figs 1–6. LECTOTYPE ♀, FRANCE: Provence (*Millière*) (genitalia slide no. 382c, Sattler; MNHN, Paris), here designated [examined]. [Synonymized by Stainton, 1867 : 14.]

Alucita olbienella Millière; Wocke, 1861 : 191. Incorrect subsequent spelling of *olbiaella* Millière.

Hypsolophus siewersiellus Christoph, 1867, *Stettin. ent. Ztg* **28** : 239. Syntypes, U.S.S.R.: S. Russia, Krasnoarmeysk ('Sarepta') (*Christoph*) (depository unknown). [Synonymized by Wocke, 1871 : 290.]

Gelechia plutelliformis Staudinger; Stainton, 1867 : 14.

Gelechia plutelliformis Staudinger; Wocke, 1871 : 290.

Gelechia plutelliformis Staudinger; Christoph, 1885 : 158.

Gelechia sinuatella Walsingham, 1904, *Entomologist's mon. Mag.* **40** : 223. LECTOTYPE ♂, ALGERIA: Biskra, 9.iii.1895 (*Eaton*) (BMNH), here designated [examined]. [Synonymized by Sattler, 1967 : 72.]

Gelechia plutelliformis Staudinger; Powell, 1905 : 164.

Gelechia plutelliformis Staudinger; Walsingham, 1908 : 938.

Gelechia plutelliformis Staudinger; Chrétien, 1917 : 469.

Gelechia sinuatella Walsingham; Caradja, 1920 : 98.

Gelechia sinuatella Walsingham; Meyrick, 1925*a* : 79.

Gelechia plutelliformis Staudinger; Meyrick, 1925*a* : 79.

[*Teleja haligmatodes auctella* Turati, 1927 : 338 (partim). Nomen nudum. Incorrect subsequent spellings of *Teleia* Heinemann and *heligmatodes* Walsingham. Misidentification.]

Gelechia plutelliformis Staudinger; Gaede, 1937 : 203.

Gelechia sinuatella Walsingham; Gaede, 1937 : 213.

Ornativalva plutelliformis (Staudinger) Gozmány, 1955 : 311, text-figs 11, 12.

Ornativalva plutelliformis (Staudinger); Sattler, 1960 : 59, pl. 17, fig. 72, pl. 30, fig. 134.

Ornativalva plutelliformis (Staudinger); Kasy, 1962 : 76.

Ornativalva plutelliformis (Staudinger); Sattler, 1967 : 72, 88, pl. 1, figs 3, 4, pl. 7, fig. 36, pl. 13, fig. 62.
Ornativalva plutelliformis (Staudinger); Zocchi, 1971 : 61.

Head (Pl. 5, figs 33–35).
GENITALIA ♂. Sattler, 1967, pl. 7, fig. 36.
GENITALIA ♀. Sattler, 1967, pl. 13, fig. 62.

REMARKS. *G. plutelliformis* Staudinger was described from 2 ♀ which Staudinger bred at the end of June 1858, from larvae collected on *Tamarix* near Chiclana. Both specimens are now preserved in coll. Staudinger (MNHU, Berlin).

A. olbiaella Millière was described from an unspecified number of specimens which Millière bred on *Tamarix gallica* Linnaeus or collected as adults in S. France: Provence, Toulon and Hyères area. The lectotype ♀ bears the label '*Alucita Olbiaella* Mill. sp. nov.' but no further data.

H. siewersiellus Christoph was described from an unspecified number of specimens which Christoph bred on *Tamarix laxa* Willdenow or collected as adults near Sarepta. No type-material has been traced. The synonymy of *siewersiellus* was discussed in detail by Walsingham (1908 : 938).

G. sinuatella Walsingham was described from eleven specimens of both sexes, including 'type, ♂ (8298); ♀ (96 594)'. The specimen bearing Walsingham's number 8298 and referred to as 'type ♂' in the original description and on the specimen label is here designated as the lectotype. The specimen labelled 'type ♀' bears Walsingham's number 96 589, whereas the specimen referred to as 'type ♀ (96 594)' in the original description is labelled 'paratype 8/9'. Ten of the eleven original specimens are now preserved in BMNH.

A ♂ from Italy: Calabria has a short dark basal streak on the inner margin of the fore wing. The absence of the basal streak usually distinguishes *plutelliformis* from some other similar species.

For a discussion of *auctella* (nomen nudum) see *triangulella* (p. 128) and *antipyramis* (p. 129).

O. plutelliformis, one of the commonest and most widespread *Ornativalva* species, is recorded in more than 60 publications.

BIOLOGY. Host-plants: *Tamarix gallica* Linnaeus (Millière, 1861 : 193); *T. laxa* Willdenow (recorded by Christoph, 1867 : 239, as *T. laxa* and *pallasii*. *T. pallasii* Desvaux is currently considered to be a synonym of *T. laxa*.); *T. canariensis* Willdenow or *T. africana* Poiret (recorded by Walsingham, 1908 : 938, as *T. gallica* which does not occur in the Canary Islands); *T. parviflora* de Candolle (Kasy, 1962 : 76); unspecified species of *Tamarix* (moths bred by Staudinger, Lucas, Kasy and Gerling). One specimen in MNHN, Paris, bears the label '*Rhus oxyacanthe*'; however, it is unlikely that *Rhus* is a host-plant of *plutelliformis*.

As far as can be seen from the literature (Staudinger, 1859 : 239; Millière, 1861 : 193; Christoph, 1867 : 239; 1885 : 158; Powell, 1905 : 164; Walsingham, 1908 : 938; Chrétien, 1917 : 469; Kasy, 1962 : 76; Zocchi, 1971 : 61) the larva lives free on *Tamarix* species. It has been described as varying in colour from dark green to reddish and brown. Larva and pupa have been illustrated in colour by Millière

(1861, liv. 4, pl. 1, figs 1–3). Pupation takes place in or on the ground in a light cocoon that is covered with small particles of soil. Hibernation probably takes place in the pupal stage. Millière concluded from his observations of larvae and adults that *plutelliformis* is probably single-brooded in southern France; however, Powell observed larvae in the same area in June as well as August and September. There may be one or two clearly defined generations in southern Europe whereas *plutelliformis* probably breeds continually where the climatic conditions are suitable. Larvae have been observed by the above authors in May and June (Turkmeniya), June, August and September (S. France), October and November (Tunisia), December and January (Canary Islands). Moths have been collected through all months of the year. Dates of capture in North Africa range from February till August.

DISTRIBUTION. Spain; S. France; Italy; Yugoslavia; Hungary; Rumania; Turkey; Cyprus; U.S.S.R. (S. Russia); Madeira (Madeira, Porto Santo); Canary Islands (Tenerife, Gran Canaria); Morocco; Algeria; Tunisia; Libya; Egypt (Sinai); Sudan; Israel; Jordan; Lebanon; Syria; Saudi Arabia; Iraq; Iran; Afghanistan; Pakistan. According to the literature also found in U.S.S.R. (Turkmeniya) (Christoph, 1885 : 158). The record for Kuwait (Amsel, 1955*b* : 126) is erroneous and applies to *triangulella* (see p. 128). No records are available for Portugal, Albania, Greece and Bulgaria, although *plutelliformis* must occur there.

FURTHER MATERIAL EXAMINED.

ITALY: 1 ♂, Calabria, Marcellina (Cosenza), 20.ix.1971 (*Pelham-Clinton*) (RSM, Edinburgh); 1 ♀, Calabria, Gizzeria Lido, 1.–15.v.1971 (*de Medina Alberich*) (BMNH); 1 ♂, [Sicily,] Licata, viii. 1906 (*Re*) (BMNH). RUMANIA: 1 ♀, [Dobrogea,] Vasile-Roaita, 18.vii.1947 (*Popescu-Gorj*) (MINGA, Bucharest); 1 ♂, [Dobrogea,] Sfintu Gheorghe delta, 12.viii.1971 (*Popescu-Gorj*) (MINGA, Bucharest); 2 ♀, [Dobrogea,] Eforie Sud, 9.vii.1947, 24.viii.1948 (*Popescu-Gorj*) (MINGA, Bucharest). TURKEY: 1 ♂, 2 ♀, 40 km SW. of Elazig, 900 m, 18.vi.1969 (*Kasy*) (NM, Vienna); 2 ♂, Eceabat, *Tamarix*, moths emerged 25.viii.1972 (Gerling) (TAU, Tel-Aviv). CYPRUS: 1 ♂, 1 ♀, Skylloura, 8.ix.1967 (*Zahradnik*) (NM, Prague) [first record for Cyprus]. LIBYA: 1 ♂, Cyrenaica, vii. 1926 (*Krüger*) (IE, Bolzano). EGYPT: 1 ♂, [Sinai,] Wadi Feiran ('Wadi Feran'), 4.iii.1935 (collector unknown) (BMNH). ISRAEL: 1 ♂, Tel-Aviv, 24.ix.1971 (*Kugler*) (TAU, Tel-Aviv); 1 ♂, Ein el Turaba, larva on *Tamarix*, moth emerged 28. ix. (collector unknown) (TAU, Tel-Aviv). AFGHANISTAN: 2 ♂, Ghorband valley, N. of Kabul, 1900 m, 30.vii.1965 (*Kasy & Vartian*) (NM, Vienna).

Ornativalva grisea Sattler, 1967

Ornativalva grisea Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 73, pl. 7, fig. 37, pl. 14, fig. 63. Holotype ♂, AFGHANISTAN: N. Afghanistan, Polichomri, 700 m, 5.vi.1956 (*Amsel*) (genitalia slide no. 294b, Sattler; LN, Karlsruhe) [examined].

GENITALIA ♂. Sattler, 1967, pl. 7, fig. 37.
GENITALIA ♀. Sattler, 1967, pl. 14, fig. 63.

BIOLOGY. Host-plant unknown. Moths have been collected in May–July.

DISTRIBUTION. Afghanistan.

Ornativalva species 6

(Pl. 19, fig. 100; Pl. 26, fig. 121)

GENITALIA ♂ (Pl. 19, fig. 100). Costa slender, distally somewhat dilated, as long as sacculus. Harpe digitate, slightly shorter than costa. Valva longer than costa, pointed. Sacculus narrow, shorter than valva, distal third not fused with valva, rounded. Aedeagus with bulbous base, tapered, apical third curved.

GENITALIA ♀ (Pl. 26, fig. 121). Lateral area of fine wrinkles on eighth segment marked off by curved fold. Apophysis anterior rod-like, distally slightly dilated. Antrum one-half length of apophysis anterior, posterior margin triangularly extended. Signum a pair of strong teeth, basal plates connected by narrow, indistinct, sclerotized bridge. Teeth of signum with dentate margin.

REMARKS. The moths are externally similar to *plutelliformis* and *grisea*. The ♂ genitalia agree with those of *grisea* but the harpe appears to be longer. The ♀ genitalia are unusual for the *plutelliformis*-group and resemble more those of the *erubescens*-group.

The males and females were collected in different localities and, although they agree well externally, their association must still be considered as doubtful.

BIOLOGY. Host-plant unknown. The moths have been collected by Kaszab in June in localities where *Tamarix* occurs (Kaszab, 1966 : 591; 1968 : 22).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

MONGOLIA: 2 ♂, South Gobi aimak, 100 km W. of borderpost Ovot Chuural, 1250 m, 22.vi.1967 (*Kaszab*, no. 834) (TM, Budapest; BMNH); 1 ♀, Gobi Altaj aimak, Zachuj Gobi, 10 km N. of Chatan chajrchan mountains, 1150 m, 27.vi.1966 (*Kaszab*, no. 594) (TM, Budapest).

Ornativalva sieversi (Staudinger, 1871)

Gelechia sieversi Staudinger, 1871, *Berl. ent. Z.* **14** : 309. Lectotype ♂, U.S.S.R.: S. Russia, Krasnoarmeysk ('Sarepta') (*Christoph*) (MNHU, Berlin), designated by Sattler (1967 : 88) [examined].
Gelechia sieversi Staudinger; Wocke, 1871 : 290.
Gelechia sieversi Staudinger; Christoph, 1887 : 120.
Gelechia plutelliformis Staudinger ab. *sieversi* Staudinger; Rebel, 1901 : 144.
Gelechia sieversi Staudinger; Walsingham, 1908 : 938.
Gelechia sieversi Staudinger; Caradja, 1920 : 98.
Gelechia sieversi Staudinger; Meyrick, 1925*a* : 79.
Gelechia sieversi Staudinger; Gaede, 1937 : 212.
Ornativalva sieversi (Staudinger) Sattler, 1960 : 59, pl. 17, fig. 73, pl. 30, fig. 135.
Ornativalva sieversi (Staudinger); Sattler, 1967 : 75, 88, pl. 2, fig. 11, pl. 7, fig. 38, pl. 14, fig. 64.

GENITALIA ♂. Sattler, 1967, pl. 7, fig. 38.
GENITALIA ♀. Sattler, 1967, pl. 30, fig. 135.

REMARKS. The date of publication is generally cited as 1870; however, according to the original wrapper of 'Drittes und viertes Vierteljahrsheft', pages 209–432 were issued in January 1871.

BIOLOGY. Host-plant: (?) *Tamarix*. Staudinger stated in the original description that Christoph bred this species on *Tamarix* '. . . if I am not mistaken . . .'. A moth has been collected by Kasy and Vartian in July. Various dates on old specimens are unreliable as they often refer to the month in which a specimen was received from the collector rather than the date of capture.

DISTRIBUTION. U.S.S.R. (S. Russia); Iran (Tehran); Afghanistan. According to the literature also found in U.S.S.R. (Turkmeniya) (Christoph, 1887 : 120).

FURTHER MATERIAL EXAMINED.

AFGHANISTAN: 1 ♂, Ghorband Valley (N. of Kabul), 1900 m, 30.vii.1965 (*Kasy & Vartian*) (NM, Vienna) [first record for Afghanistan].

THE *CEROSTOMATELLA*-GROUP

(Text-figs 11, 12)

Head with enlarged scale bases or distinct frontal process. Metascutum with paired group of short broad scales (Text-fig. 1). Fore wing in some species deviating from typical *Ornativalva* pattern; inner margin without basal streak. Frenulum of ♀ double or triple. In ♂ genitalia of most species uncus developed, deeply divided. Costa, harpe and valva present, sacculus not separated from valva. Anellus lobes modified in some species. In ♀ genitalia posterior margin of eighth tergite densely set with scales. Apophysis anterior short, wide, not rod-like; bases of apophyses connected by narrow sclerotization along anterior margin of eighth sternite. No modified ostium bursae. Antrum a small sclerotized ring or absent. Signum with pair of transverse folds or ridges.

REMARKS. *O. acutivalva* sp. n. is placed in the *cerostomatella*-group mainly on account of the presence of scales – not setae – on the eighth tergite of the ♀ and the absence of a separate sacculus in the ♂. It differs from all other species of this group by the absence of modified head structures and by the long hair-like scales on the metascutum.

BIOLOGY. The host-plants of all species in the *cerostomatella*-group are still unknown; however, some of the species have been collected as adults in localities where *Tamarix* occurs or in association with other Lepidoptera species known to feed on *Tamarix*.

Ornativalva mixolitha (Meyrick, 1918)

(Pl. 1, fig. 9; Pl. 4, fig. 28; Pl. 8, figs 51–56; Pl. 27, fig. 122; Text-fig. 12)

Phthorimaea mixolitha Meyrick, 1918 : 135.

Head (Pl. 8, figs 51–56) with frontal modifications variable, enlarged scale bases more or less regularly distributed over frons and part of vertex. Sometimes weak or strong frontal process developed.

GENITALIA ♂. Clarke, 1969, pl. 153, figs 2a–b; Sattler, 1967, pl. 8, fig. 40.

GENITALIA ♀ (Pl. 27, fig. 122).

REMARKS. The North African subspecies *bipunctella* differs from typical *mixolitha* by the ochreous – not grey – colour of the fore wing. No differences are found in the genitalia.

The frenulum of the ♀ is double. The ♀ genitalia do not differ from those of *cerostomatella*, *angulatella* and *mongolica*.

BIOLOGY. Host-plant unknown. The moths are usually collected in association with other *Ornativalva* species and it seems likely that the larva feeds on *Tamarix*. Moths have been taken by various collectors in February–October.

DISTRIBUTION. Morocco; Algeria; Tunisia; U.S.S.R. (S. Russia); Turkey; Sudan; Iraq; Iran; Afghanistan; Pakistan; India (Bihar); Mongolia.

Ornativalva mixolitha mixolitha (Meyrick, 1918)

(Pl. 1, fig. 9; Pl. 4, fig. 28; Pl. 8, figs 51–56; Pl. 27, fig. 122; Text-fig. 12)

Phthorimaea mixolitha Meyrick, 1918, *Exot. Microlepidopt.* **2** : 135. Holotype ♂, INDIA: Bihar, Pusa, vi. 1911 (*Fletcher*) (genitalia slide no. 8307, Clarke; BMNH) [examined].
Phthorimaea mixolitha Meyrick; Meyrick, 1925*a* : 92.
Phthorimaea mixolitha Meyrick; Gaede, 1937 : 273.
Ornativalva mixolitha (Meyrick) Amsel, 1966 : 128.
Ornativalva mixolitha (Meyrick); Sattler, 1967 : 80.
Phthorimaea mixolitha Meyrick; Clarke, 1969 : 307, pl. 153, figs 2–2b.

Head (Pl. 8, figs 51–56).
GENITALIA ♂. Clarke, 1969, pl. 153, figs 2a–b.
GENITALIA ♀ (Pl. 27, fig. 122).

REMARKS. The specimens from Turkey and a single ♀ from Mongolia are a little bigger and more distinctly marked than typical *mixolitha*. They also differ by their frontal structure. An arc of strongly raised scale bases extends between the antennal pits above the transfrontal sulcus. The strongly developed frontal process is surrounded by three or four irregular rings of enlarged scale bases (Pl. 8, figs 54–56). In a series of specimens from the Sudan the enlarged scale bases are more or less evenly distributed over the frontal area and there is no indication of a frontal process (Pl. 8, figs 51–53). In material from S. Iran specimens with and without a frontal process are found as well as intermediate stages. Specimens from Afghanistan and Pakistan show also some indication of a frontal process. In two specimens from S. Russia: Sarepta the enlarged scale bases are concentrated in the centre of the frons, but no definite process is developed.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in February–August and October.

DISTRIBUTION. U.S.S.R. (S. Russia); Turkey; Sudan; Iraq; Iran; Afghanistan; Pakistan; India (Bihar); Mongolia.

FURTHER MATERIAL EXAMINED.

U.S.S.R.: 1 ♂, 1 ♀, S. Russia, Krasnoarmeysk ('Sarepta'), 5., 6.viii.1870 (*Christoph*) (BMNH) [first record for the U.S.S.R.]. TURKEY: 22 ♂, 17 ♀, Taurus, S. of Mut, 23.v.1969 (*Arenberger*; *Kasy*) (coll. Arenberger, Vienna; coll. Jäckh, Bidingen; NM, Vienna; BMNH); 1 ♂, 1 ♀, road Ankara-Kayseri, 1000 m, 26.vii.1965 (*Glaser*)(coll. Glaser, Vienna); 1 ♂, Köprüköy, Kizilirmak, 750 m, 20.–22.vi.1969 (*Hahn*) (coll. Glaser, Vienna) [first record for Turkey]. SUDAN: 1 ♂, Wadi Halfa, 20.–25.i.1962 (*Nubien Exp. Mus. Vind.*) (NM, Vienna); 2 ♂, 1 ♀, Faras W, N. of Wadi Halfa, 3.ii.1962 (*Nubien Exp. Mus. Vind.*) (NM, Vienna); 1 ♂, 1 ♀, Khor Musa Pascha, S. of Wadi Halfa, 27. i., 10.ii.1962 (*Nubien Exp. Mus. Vind.*) (NM, Vienna). IRAN: 1 ♀, [Luristan,] 8 km E. of Bandar-Abbas, 23.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 13 ♂, 20 ♀, [Luristan,] 17 km E. of Bandar-Abbas, dunes, 23.iii.–15.iv.1972, 15.–26.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 1 ♂, 2 ♀, [Luristan,] 22 km E. of Bandar-Abbas, 19.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 3 ♂, 7 ♀, [Luristan], 30 km E. of Bandar-Abbas, 3.iv.1970, 25.iii.1972, 8.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna; BMNH); 2 ♀, [Luristan,] 13 km NE. of Bandar-Abbas, 24.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♀, [Luristan,] 22 km N. of Bandar-Abbas, 18.iv.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 2 ♂, 3 ♀, [Luristan,] 25 km S. of Minab, 4.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna); 1 ♂, Baluchestan, Iranshar, 800 m, 11.–21.v.1954 (*Richter & Schäuffele*) (SMN, Stuttgart) [first record for Iran.] AFGHANISTAN: 2 ♂, E. of Kandahar, 27.vi.1963 (*Kasy & Vartian*) (NM, Vienna) [first record for Afghanistan]. PAKISTAN: 2 ♂, 2 ♀, Karachi, vicinity of airport, 23.ii.–9.iii.1961 (*Vartian*) (NM, Vienna) [first record for Pakistan]. MONGOLIA: 1 ♀, Bajanchongor aimak, between Bajangobi and Somon Bajanleg, 26 km SE. of Bajanleg, 1450 m, 1.vii.1967 (*Kaszab*, no. 876) (TM, Budapest) [first record for Mongolia].

Ornativalva mixolitha bipunctella Sattler, 1967

Ornativalva mixolitha bipunctella Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 81, pl. 8, fig. 40. Holotype ♂, ALGERIA: Laghouat, 18.–20.viii.1919 (*Dumont*) (genitalia slide no. 399c, Sattler; MNHN, Paris) [examined].

Ornativalva mixolitha bipunctella Amsel, 1966 : 128. Nomen nudum.

Head as in the nominate subspecies.

GENITALIA ♂. Sattler, 1967, pl. 8, fig. 40.

GENITALIA ♀. As in the nominate subspecies.

REMARKS. The frontal structures of *bipunctella* are variable as in the nominate subspecies; however, no extreme frontal process as in Turkish and Mongolian *mixolitha* was observed.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in March–September.

DISTRIBUTION. Morocco; Algeria; Tunisia.

Ornativalva angulatella (Chrétien, 1915)

(Pl. 9, figs 57–59)

Gelechia angulatella Chrétien, 1915, *Annls Soc. ent. Fr.* **84** : 318. Lectotype ♀, TUNISIA: Tozeur, 20.vi.1907 (*Chrétien*) (MNHN, Paris), designated by Sattler (1967 : 87) [examined].

Gelechia angulatella Chrétien; Meyrick, 1925*a* : 79.

Gelechia nigrosubvittatella Lucas, 1933, *Bull. Soc. ent. Fr.* **38** : 199. Holotype ♂, ALGERIA: Guelt-es-Stel, 11.x.1931 (*Lucas*) (genitalia slide no. 404c, Sattler; MNHN, Paris) [examined]. [Synonymized by Sattler, 1967 : 83.]
Gelechia angulatella Chrétien; Gaede, 1937 : 147.
Gelechia nigrosubvittatella Lucas; Gaede, 1937 : 193.
Ornativalva angulatella (Chrétien) Sattler, 1967 : 81, 87, pl. 8, fig. 41.

Head (Pl. 9, figs 57–59) without frontal process. Enlarged scale bases evenly distributed over frons and anterior part of vertex.

GENITALIA ♂. Sattler, 1967, pl. 8, fig. 41.

REMARKS. The frontal modifications are similar to those of *cerostomatella* and certain specimens of *mixolitha*. The enlarged scale bases of *cerostomatella* are stronger and appear to be fewer. *O. mixolitha* possesses no enlarged scale bases on the vertex except a single row above the transfrontal sulcus.

The frenulum of the ♀ is triple. The ♀ genitalia do not differ from those of *mixolitha*, *cerostomatella* and *mongolica*.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in March–June and October.

DISTRIBUTION. Algeria; Tunisia.

Ornativalva cornifrons sp. n.

(Pl. 1, fig. 13; Pl. 4, fig. 29; Pl. 12, figs 78–80; Pl. 19, fig. 101; Pl. 27, fig. 123)

♂, ♀. 5·0–6·0 mm. Head (Pl. 12, figs 78–80) with strong frontal process with smaller dorsal and ventral processes at base, surrounded by ring of approximately 20 strongly enlarged scale bases. Head white, narrow stripe along eye brown. Labial palpus white, outer surface of first segment brown; second segment with loose brush of long white and brown scales below. Thorax white, tegula brown. Fore wing with dark brown longitudinal band which reaches costa before apex and is interrupted near apex. Termen with dark line along base of fringes. Fringes with dark dividing line and tips. Frenulum of ♀ double.

GENITALIA ♂ (Pl. 19, fig. 101). Eighth tergite weakly sclerotized, pair of narrow transverse stronger sclerotizations on anterior margin and pair of larger ones posteriorly near lateral margin. Posterior margin of uncus with number of long setae, medially with small emargination. Anterior margin of tegumen with deep emargination. Saccus long, wide, gradually narrowing, distally rounded. Anellus lobes large, triangular, setose. Costa distinctly longer than valva, narrow, with parallel margins, apical portion not clavate. Harpe very short, with long terminal seta. Valva almost triangular, outer surface near dorsal margin with long stiff seta in group of shorter setae. Sacculus not separated from valva. Aedeagus with bulbous base; curved apical portion strong, apex rounded.

GENITALIA ♀ (Pl. 27, fig. 123). Posterior margin of seventh tergite sinuate. Apophyses anteriores very short, bases connected by narrow sclerotization along anterior margin of eighth sternite. Antrum with short sclerotized ring, opens directly into corpus bursae; no long ductus bursae. Corpus bursae elongate, inner surface minutely spined; cervix bursae and antrum without minute spines. Signum near middle of corpus bursae, transverse, with pair of serrated ridges.

REMARKS. *O. cornifrons* differs from most *Ornativalva* species by the conspicuous longitudinal band of the fore wing. *O. cerostomatella* with a similar band is generally larger and the ground colour of the fore wing is ochreous, not white. The thorax of *cerostomatella* is divided by a dark longitudinal line and the head lacks a frontal process. In the ♂ genitalia *cornifrons* differs from all other species of the *cerostomatella*-group (except *acutivalva*) by the uncus, which is not deeply divided, the short triangular valva and the large saccus. The aedeagus is similar to that of *curvella* but differs in details of the apex structure.

The ♀ genitalia are similar to those of *afghana*. The periostial region is completely membranous whereas in *afghana* it is partially sclerotized. The posterior margin of the seventh tergite is sinuate in *corniforns* but straight in *afghana*.

BIOLOGY. Host-plant unknown. The type-specimens have been collected by Kaszab in June–July in a locality where *Tamarix* occurs (Kaszab, 1968 : 31).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest).

Paratypes. MONGOLIA: 10 ♂, 3 ♀, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest; BMNH); 1 ♂, Bajanchongor aimak, oasis Dzun mod, 100 km S. of Somon Schine žinst, 1300 m, 29.vi.1967 (*Kaszab*, no. 869) (TM, Budapest).

Ornativalva cerostomatella (Walsingham, 1904)

(Pl. 9, figs 60–62; Text-fig. 11)

Gelechia cerostomatella Walsingham, 1904, *Entomologist's mon. Mag.* **40** : 266. Holotype ♀ [not ♂, as stated by Walsingham], ALGERIA: Biskra, 15.iv.1903 (*Walsingham*) (BMNH) [examined].

Gelechia tripartitella Mabille, 1907, *Bull. Soc. ent. Fr.* **1907** : 79. Lectotype ♀, TUNISIA: Nefta, Djerid, v. 1904 (*Lucas*) (genitalia slide no. 369c, Sattler; MNHN, Paris), designated by Viette & Fletcher (1968 : 393) [as holotype] [examined]. [Synonymized by Chrétien, 1917 : 469.]

Gelechia cerostomatella Walsingham; Chrétien, 1917 : 469.

Gelechia cerostomella Walsingham; Caradja, 1920 : 99. Incorrect subsequent spelling of *cerostomatella* Walsingham.

Gelechia cerostomella Meyrick, 1925*a*, *Genera Insect.* **184** : 79. Unjustified emendation of *cerostomatella* Walsingham.

Gelechia biclavata Meyrick, 1934, *Exot. Microlepidopt.* **4** : 511. Holotype ♂, INDIA: Great Indian Desert, xi. 1930 (*Glennie*) (genitalia slide no. 8288, Clarke; BMNH) [examined]. [Synonymized by Sattler, 1967 : 83.]

Gelechia biclavata Meyrick; Gaede, 1937 : 150.

Gelechia cerostomella [sic] Walsingham; Gaede, 1937 : 153.

Gelechia tripartitella Mabille; Gaede, 1937 : 223.

Gelechia cerostomatella Walsingham; Amsel, 1940 : 48.

Gelechia cerostomatella Walsingham; Amsel, 1958 : 80.

Ornativalva cerostomatella (Walsingham) Sattler, 1960 : 60, pl. 17, fig. 74.

Ornativalva cerostomatella (Walsingham); Sattler, 1967 : 83, pl. 2, fig. 13, pl. 8, fig. 42, pl. 15, fig. 66.

Gelechia tripartitella Mabille; Viette & Fletcher, 1968 : 393.

Gelechia biclavata Meyrick; Clarke, 1969 : 108, pl. 54, figs 1–1b.

Head (Pl. 9, figs 60–62) without frontal process. Scale bases enlarged to coarse teeth. Gentle arc of enlarged scale bases above transfrontal sulcus; some scattered enlarged scale bases on vertex. Frons below transfrontal sulcus covered with enlarged scale bases, particularly dense concentration in centre of frons.

GENITALIA ♂. Sattler, 1967, pl. 8, fig. 42.
GENITALIA ♀. Sattler, 1967, pl. 15, fig. 66.

REMARKS. The head structure is very similar to that of typical *mixolitha*; it differs by the presence of enlarged scale bases on the vertex in addition to the arc above the transfrontal sulcus.

The frenulum of the ♀ is triple. The ♀ genitalia do not differ from those of *mixolitha*, *angulatella* and *mongolica*.

Gelechia tripartitella Mabille was described from an unspecified number of specimens. The specimen recorded as the 'holotype' by Viette & Fletcher should therefore be considered the lectotype.

Nothris minutella Turati, 1929, *Boll. Lab. Zool. gen. agr. Portici* **23** : 124, fig. 4, was previously synonymized with *O. cerostomatella* (Walsingham) on the basis of Turati's description and poor photographic illustration (Sattler, 1967 : 83). Turati based his description on three specimens; however, in his collection there is now only one ♀ without abdomen left. This specimen was made available to me by Count F. Hartig (IE, Bolzano) and bears the following labels: 'Typus' – 'Tripolitania Nord-Africa, Sidi Mesri, 21–23 Marzo 1924, Romei' – '*Nothris minutella* Trt, Typ'. It proved to be an *Anarsia* species (possibly a synonym of *Anarsia luticostella* Chrétien, 1915) and is here removed from synonymy: *Anarsia minutella* (Turati, 1929) **comb. n., sp. rev.** Consequently Libya must be eliminated from the distribution of *cerostomatella*, although the species will undoubtedly be found there.

BIOLOGY. Host-plant unknown. Moths have been taken by various collectors in February–August.

DISTRIBUTION. Mauritania; Algeria; Tunisia; Egypt; Saudi Arabia; India.

FURTHER MATERIAL EXAMINED.

MAURITANIA: 1 ♀, between Kiffa and Tidjidja, 1931 (*Steele*) (BMNH) [first record for Mauritania]. EGYPT: 1 ♀, Romani, 30.vii.1916 (*Boyd*) (BMNH) [first record for Egypt].

Ornativalva mongolica Sattler, 1967

(Pl. 1, fig. 10; Pl. 4, fig. 30; Pl. 10, figs 63–65)

Ornativalva mongolica Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 85, pl. 18, fig. 76. Holotype ♂, MONGOLIA: East Gobi aimak, Cagan Elis, 30 km ESE. of Zuun-Bajan, 800 m, 22.vi.1963 (*Kaszab*, no. 21) (TM, Budapest) [examined].

Head (Pl. 10, figs 63–65) with frons strongly prominent but without definite process. Scale bases very strong, arranged in irregular rings on frons; small group on vertex above transfrontal sulcus.

GENITALIA ♂. Sattler, 1967, pl. 18, fig. 76.

REMARKS. The frontal structure of *mongolica* is similar to that of *cerostomatella* but the frons is more prominent and the enlarged scale bases are fewer and stronger.

The frenulum of the ♀ is double. The ♀ genitalia do not differ from those of *mixolitha*, *angulatella* and *cerostomatella*.

BIOLOGY. Host-plant unknown. Moths have been collected by Kaszab in June–July in a locality where *Tamarix* occurs (Kaszab, 1968 : 31).

DISTRIBUTION. Mongolia.

FURTHER MATERIAL EXAMINED.

MONGOLIA: 3 ♂, Uburchangaj aimak, 130 km ESE. of Somon Bajanleg, 1150 m, 3.vii.1967 (*Kaszab*, no. 882) (TM, Budapest; BMNH); 1 ♀, Bajanchongor aimak, 8 km ESE. of Somon Bajanleg, 1350 m, 2.vii.1967 (*Kaszab*, no. 879) (TM, Budapest); 2 ♀, Bajanchongor aimak, SE. corner of lake Orog nur, 1200 m, 23.vi.1964 (*Kaszab*, no. 183) (TM, Budapest).

Ornativalva afghana Sattler, 1967

(Pl. 1, figs 11, 12; Pl. 4, fig. 31; Pl. 11, figs 69–74; Pl. 12, figs 75–77; Pl. 20, fig. 102; Pl. 27, fig. 124)

Ornativalva afghana Sattler, 1967, *Beitr. naturk. Forsch. SüdwDtl.* **26** (3) : 75, pl. 17, fig. 72, pl. 18, fig. 77; pl. 19, fig. 79. Holotype ♂, AFGHANISTAN: SE. of Shindan, ca 150 km S. of Herat, 25.vi.1963 (*Kasy & Vartian*) (genitalia slide no. 3276; NM, Vienna) [examined].

Head (Pl. 11, figs 69–74; Pl. 12, figs 75–77) with enlarged scale bases fused to form strong arc above transfrontal sulcus. Entire frons densely set with enlarged scale bases. Frontal process short, truncate.

GENITALIA ♂ (Pl. 20, fig. 102).

GENITALIA ♀ (Pl. 27, fig. 124).

REMARKS. The Mongolian specimens differ from the type-series from Afghanistan. On the head of Mongolian specimens the arc above the transfrontal sulcus is more strongly developed, the frontal process is approximately twice the length of that of specimens from Afghanistan and the enlarged scale bases on the frons are fewer and stronger. The fore wings of Mongolian specimens appear narrower and the line that separates the dark costal and the light posterior half of the wing is clearly W-shaped in the fold. In the ♂ genitalia the harpe is narrower in Mongolian specimens. In the ♀ genitalia the eighth tergite of specimens from Afghanistan has a distinct dent above the spiracle (this dent is not visible in the illustration given by Sattler, 1967, pl. 17, fig. 72) and the sclerotization on the anterior margin of the eighth sternite is much broader than in the Mongolian specimens and surrounds most of the ostium bursae.

The frontal structure of the Mongolian specimens resembles that of *mixolitha* specimens from Turkey and Mongolia, but the frontal process is clearly truncate in *afghana*.

The frenulum of the ♀ is triple.

BIOLOGY. Host-plant unknown. The Mongolian specimens have been collected by Kaszab in a locality where *Tamarix* occurs (Kaszab, 1966 : 591). Moths have been collected by Kasy and Vartian and Kaszab at the end of June.

DISTRIBUTION. Afghanistan; Mongolia.

FURTHER MATERIAL EXAMINED.

MONGOLIA: 6 ♂, 1 ♀, Gobi Altaj aimak, Zachuj Gobi, 10 km N. of Chatan chajrchan mountains, 1150 m, 27.vi.1966 (*Kaszab*, no. 594) (TM, Budapest; BMNH) [first record for Mongolia].

Ornativalva curvella sp. n.

(Pl. 10, figs 66–68; Pl. 20, fig. 103; Text-figs 26, 27)

♂. 7·0 mm. Head (Pl. 10, figs 66–68) with enlarged scale bases on vertex fused to form strong arc above transfrontal sulcus. Enlarged scale bases on frons strong, arranged in irregular rings, densely concentrated below transfrontal sulcus; frons irregularly prominent. Labial palpus pale, outer surface of second segment with light brown patches near base and below apex. Costal half of fore wing greyish brown, darkest at fold, with two dark angular projections extending across fold into lighter posterior half of wing. Small dark brown dot in cell and slightly larger dot at end of cell.

GENITALIA ♂ (Pl. 20, fig. 103; Text-figs 26, 27). Eighth tergite membranous with narrow transverse sclerotized band on anterior margin and pair of longitudinal bands laterally near posterior margin. Eighth sternite rounded, weakly sclerotized. Uncus strongly developed, posteriorly truncate, lateral portion strongly sclerotized, large posterior area of tegumen membranous. Inner surface of uncus set with small number of long setae near posterior margin. Costa nearly as long as valva, narrow, distal two-thirds strongly curved dorsad. Harpe a broad rounded process at base of costa. Distal two-thirds of valva narrow, distal third strongly curved dorsad, apex rounded, without terminal spine. Anellus lobes rounded. Saccus large. Aedeagus with clearly defined bulbous base and narrow, strongly curved apical portion.

GENITALIA ♀. Unknown.

REMARKS. The frontal structures of *curvella* are similar to those of *mongolica* but differ by the clearly defined arc above the transfrontal sulcus and the irregular process below the sulcus. The only specimen of *curvella* is poorly preserved. The ♂ genitalia with the well developed uncus and strongly curved costa and valva do not closely resemble those of any other species.

BIOLOGY. Host-plant unknown. The holotype has been collected by Kaszab at light in a locality where *Tamarix* occurs (Kaszab, 1966 : 591).

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: Gobi Altaj aimak, Zachuj Gobi, 10 km N. of Chatan chajrchan mountains, 1150 m, 27.vi.1966 (*Kaszab*, no. 594) (genitalia slide no. 647d, Sattler; TM, Budapest).

Ornativalva acutivalva sp. n.

(Pl. 1, fig. 14; Pl. 4, fig. 32; Pl. 20, fig. 104; Pl. 27, fig. 125)

♂, ♀. 5·0–6·0 mm. Head without enlarged scale bases or frontal process. Metascutum with paired group of narrow, hair-like scales (Text-fig. 2). Head ochreous. Labial palpus whitish, second segment with moderate brush below, only twice as wide as third segment, with brown bands near base and apex with some scattered brown scales in between; apex and broad ring around middle of third segment brown. Scape of antenna brown with white distal ring; flagellum above dark with lighter rings. Thorax ochreous, tegula brown with ochreous apex. Fore wing narrow, costal half mostly dark brown, dorsal half ochreous; dark area distally narrower, not reaching apex, barely reaching fold. Projections of dark area touch fold at one-third and two-thirds without crossing it. Small dark dots in cell and at end of cell in ochreous area but connected with dark area. Some dark scales along termen.

GENITALIA ♂ (Pl. 20, fig. 104). Uncus pointed. Costa slender, as long as valva. Harpe short, rounded. Valva broad at base, tapering, apex rounded, without terminal spine. No separate sacculus. Anellus lobes broad at base, bulging, narrowed at distal third. Aedeagus with bulbous base, distal two-thirds strong, bent near middle, apex rounded.

GENITALIA ♀ (Pl. 27, fig. 125). Apophysis posterior as long as eighth segment. Apophysis anterior very short. Eighth tergite with irregular rows of scale bases at posterior margin. Ductus bursae with open sclerotized ring near ostium bursae. Ductus bursae short, wide, not coiled, gradually widening into corpus bursae. Signum oval, both ends serrated, with pair of transverse folds.

REMARKS. The structure of the anellus and the absence of a separate sacculus in the ♂ genitalia and the presence of scales – not setae – on the eighth tergite, the short apophyses anteriores and the structure of the signum in the ♀ genitalia place *acutivalva* in the *cerostomatella*-group. *O. acutivalva* differs from all other species of the *cerostomatella*-group by the absence of frontal modifications of the head and the presence of long scales on the metascutum. The anellus lobes are similar to those of *angulatella* and *cerostomatella*. All three available ♀ have a variable number of frenulum setae. Two specimens have three setae on the left hind wing and two on the right whereas the third specimen has two on the left and three on the right.

BIOLOGY. Host-plant unknown. Moths have been collected by Kaszab in July.

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED.

Holotype ♂, MONGOLIA: South Gobi aimak, 10 km NNE. of the town Dalanzadgad, 1450 m, 7.vii.1967 (*Kaszab*, no. 898) (TM, Budapest).

Paratypes. MONGOLIA: 10 ♂, 3 ♀, South Gobi aimak, 10 km NNE. of the town Dalanzadgad, 1450 m, 7.vii.1967 (*Kaszab*, no. 898) (TM, Budapest; BMNH); 1 ♂, Middle Gobi aimak, 8 km NW. of Oldoch Chijd, 54 km NNW. of Somon Zogt-Ovoo, 1350 m, 9.vii.1967 (*Kaszab*, no. 905) (TM, Budapest).

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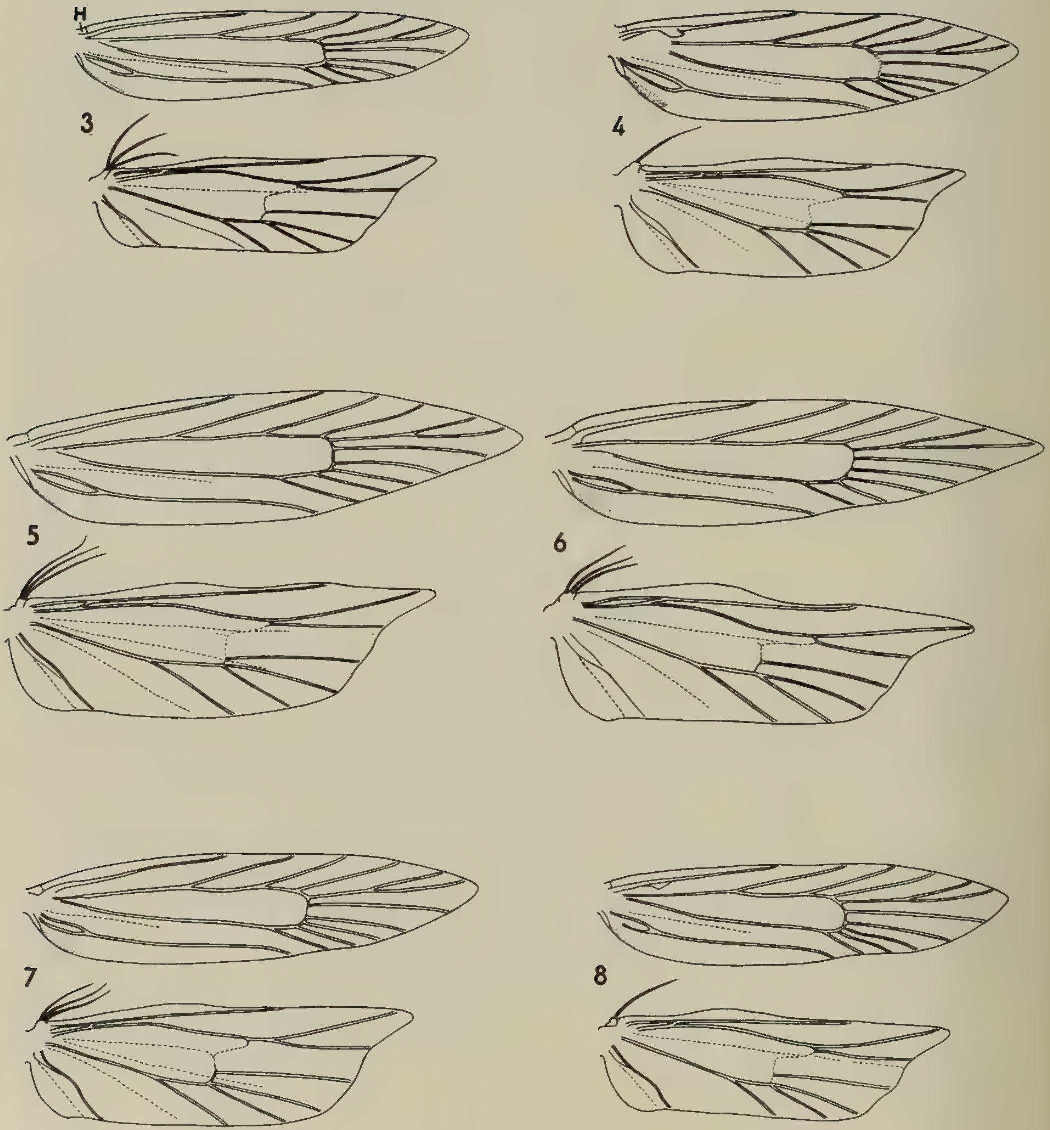
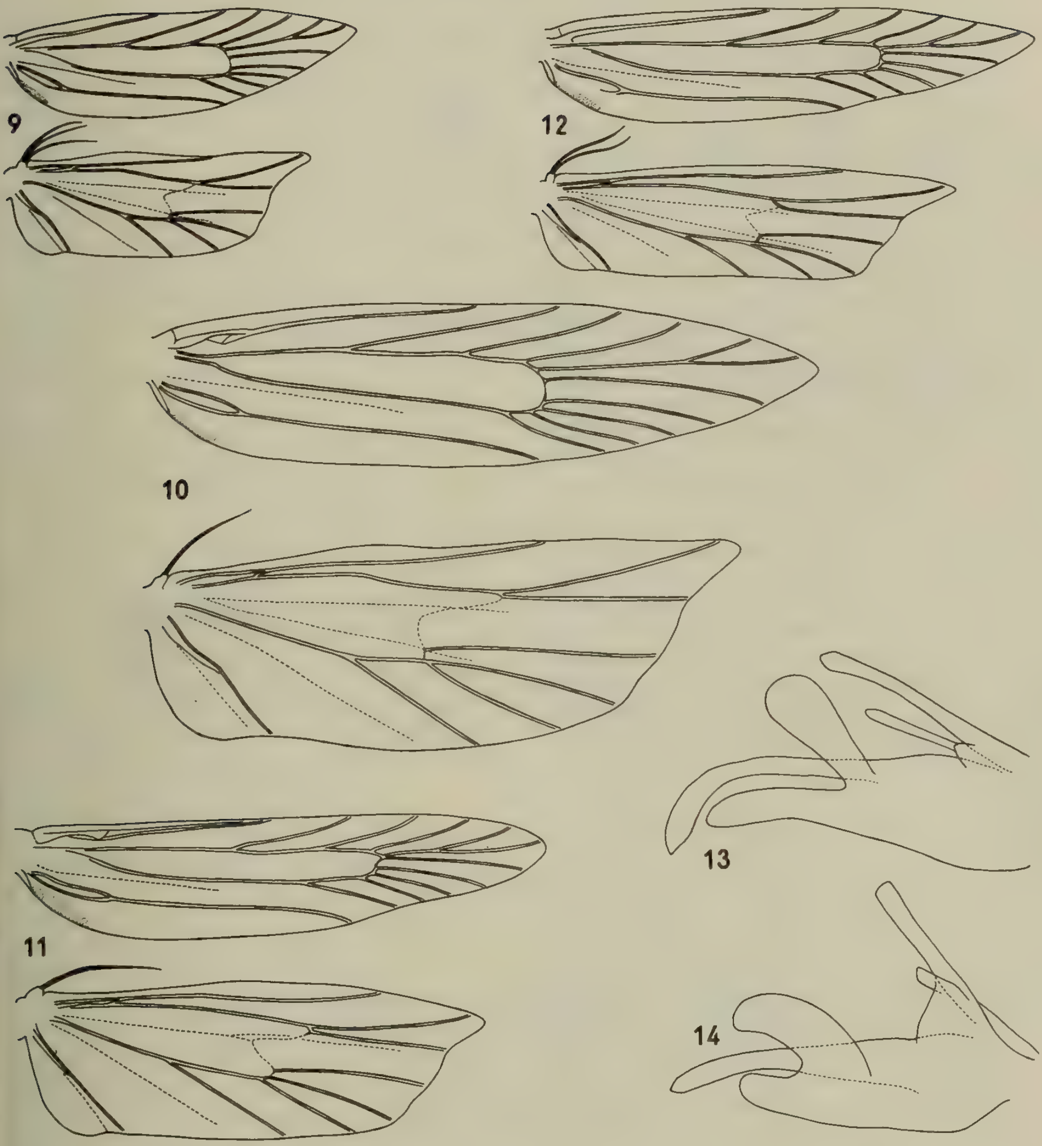


Figs 3–8. Wing venation of *Ornativalva* species. (H—humeral field.) 3, *O. heluanensis* (Debski), ♀. 4, *O. erubescens* (Walsingham), ♂. 5, *O. ornatella* Sattler, ♀. 6, *O. plicella* sp. n., ♀. 7, *O. tamariciella* (Zeller), ♀. 8, *O. indica* Sattler, ♂.



Figs 9–14. 9–12, wing venation of *Ornativalva* species. (9) *O. kalahariensis* (Janse), ♀. (10) *O. plutelliformis* (Staudinger), ♂. (11) *O. cerostomatella* (Walsingham), ♂. (12) *O. mixolitha* (Meyrick), ♀. 13–14, *O. ornatella* Sattler. Outlines of ♂ left valvae. (13) Mongolia (slide no. 14 878; BMNH). (14) Rumania (slide no. 686, Sattler; MINGA, Bucharest).

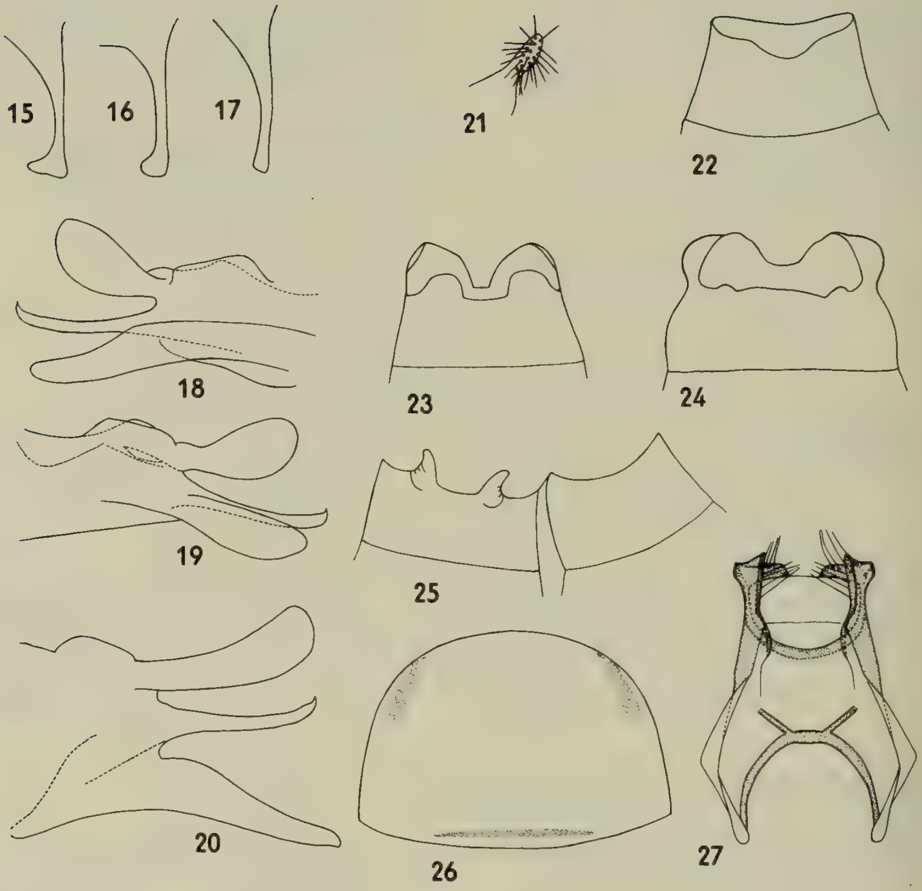


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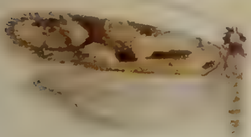
PLATE 1

Fig. 1. *Ornativalva levifrons* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 2. *O. aspera* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 3. *O. pulchella* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 4. *O. frontella* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 5. *O. ochraceofusca* Sattler. ♂. Turkey. (NM, Vienna.)
Fig. 6. *O. misma* sp. n. ♂, holotype. Sudan. (BMNH.)
Fig. 7. *O. caecigena* (Meyrick). ♀. Pakistan. (NM, Vienna.)
Fig. 8. *O. basistriga* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 9. *O. mixolitha* (Meyrick). ♀. Turkey. (BMNH.)
Fig. 10. *O. mongolica* Sattler. ♀, paratype. Mongolia. (BMNH.)
Fig. 11. *O. afghana* Sattler. ♂. Mongolia. (TM, Budapest.)
Fig. 12. *O. afghana* Sattler. ♀, paratype. Afghanistan. (BMNH.)
Fig. 13. *O. cornifrons* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 14. *O. acutivalva* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 15. *O. undella* sp. n. ♀, holotype. Iran. (NM, Vienna.)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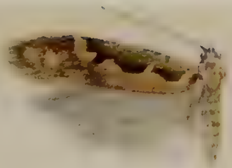
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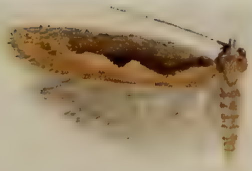
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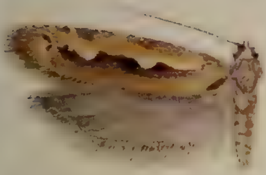
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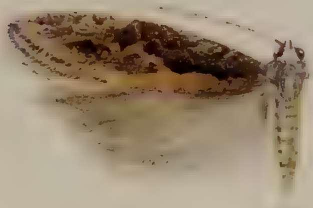
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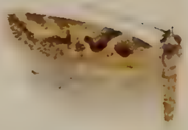
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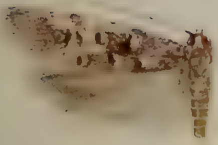
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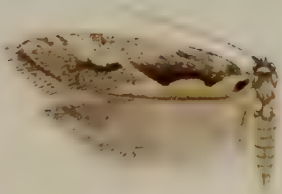
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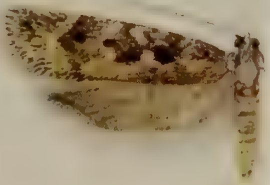
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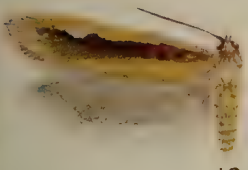
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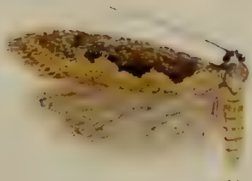
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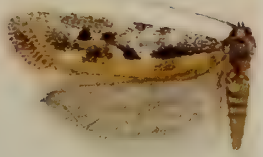
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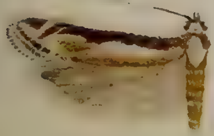
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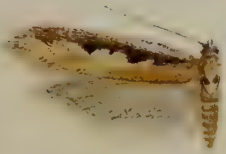
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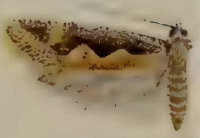
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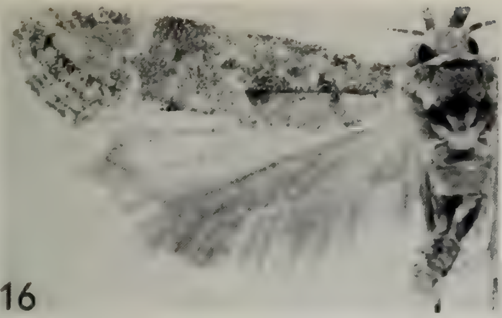
PLATE 2

Fig. 16. *Ornativalva rufipuncta* sp. n. ♂, paratype. Iran. (NM, Vienna.)
Fig. 17. *O. levifrons* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 18. *O. aspera* sp. n. ♀, paratype. Mongolia. (TM, Budapest.)
Fig. 19. *O. pulchella* sp. n. ♂, paratype. Mongolia. (TM, Budapest.)
Fig. 20. *O. frontella* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 21. *O. plicella* sp. n. ♂, paratype. Iran. (NM, Vienna.)



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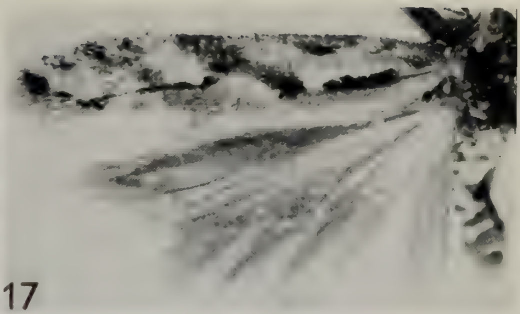

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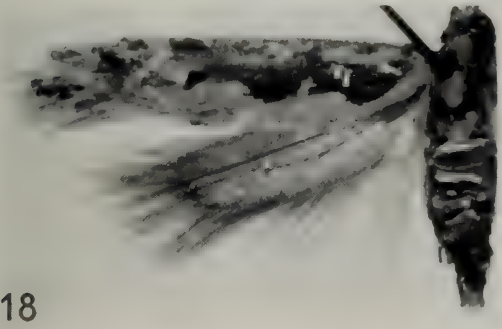

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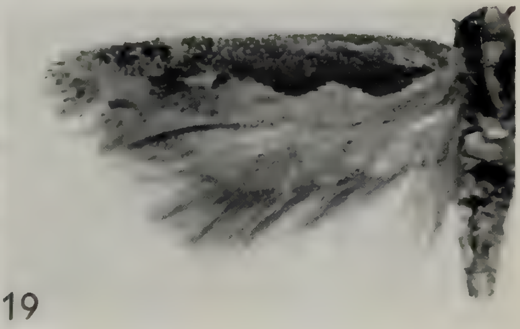

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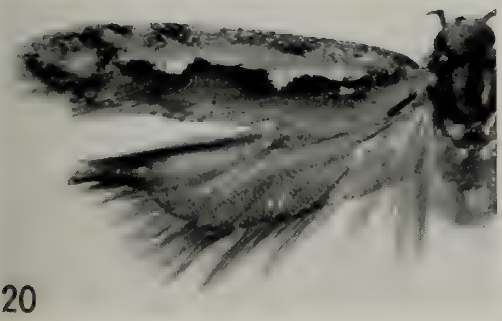

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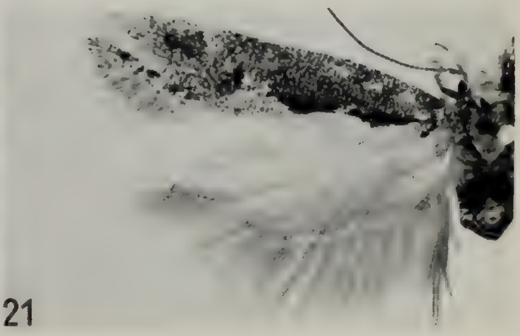

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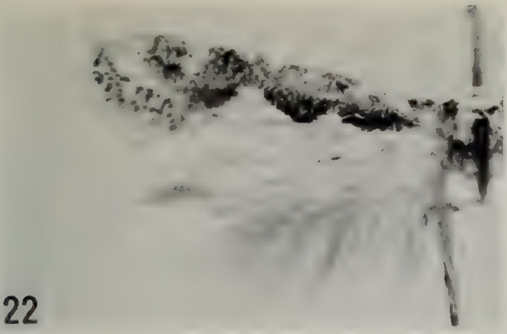
PLATE 3

FIG. 22. *Ornativalva undella* sp. n. ♀, holotype. Iran. (NM, Vienna.)
FIG. 23. *O. misma* sp. n. ♂, holotype. Sudan. (BMNH.)
FIG. 24. *O. serratisignella* Sattler. ♂. Iran. (BMNH.)
FIG. 25. *O. singula* Sattler. ♂. Mongolia. (BMNH.)
FIG. 26. *O. basistriga* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
FIG. 27. *O. basistriga* sp. n. ♀, paratype. Mongolia. (TM, Budapest.)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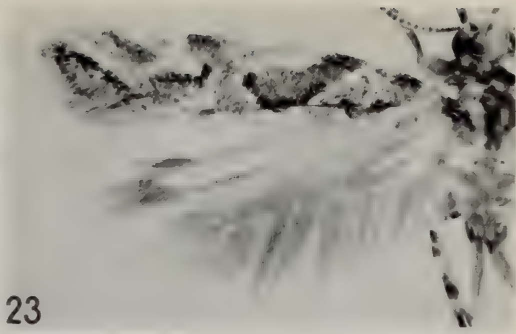
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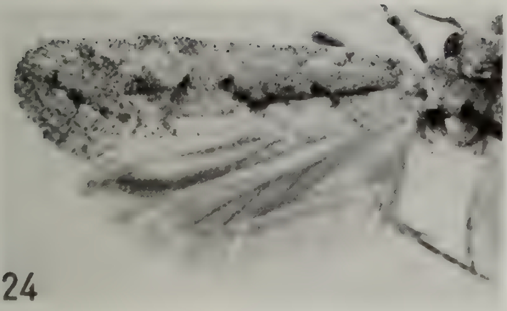
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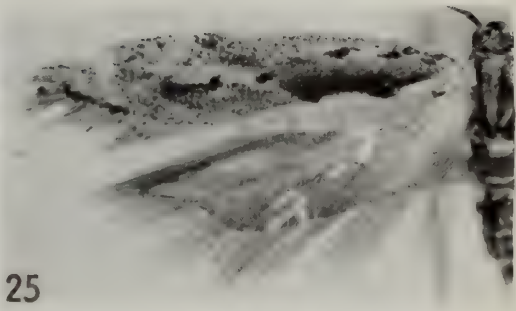
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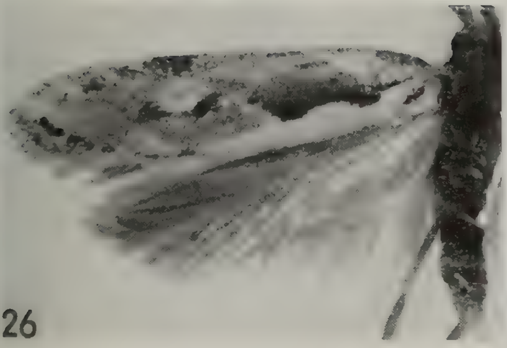
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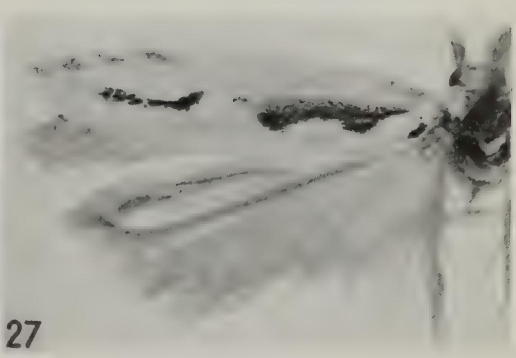
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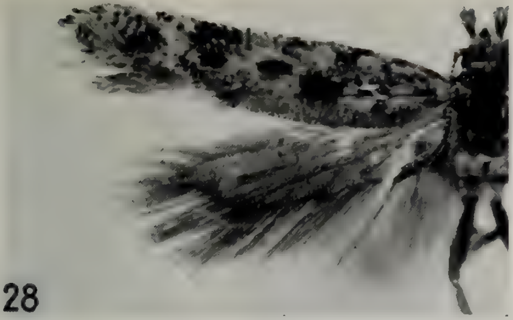
PLATE 4

Fig. 28. *Ornativalva mixolitha* (Meyrick). ♀. Mongolia. (TM, Budapest.)
Fig. 29. *O. cornifrons* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)
Fig. 30. *O. mongolica* Sattler. ♀. Mongolia. (BMNH.)
Fig. 31. *O. afghana* Sattler. ♂. Mongolia. (BMNH.)
Fig. 32. *O. acutivalva* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)



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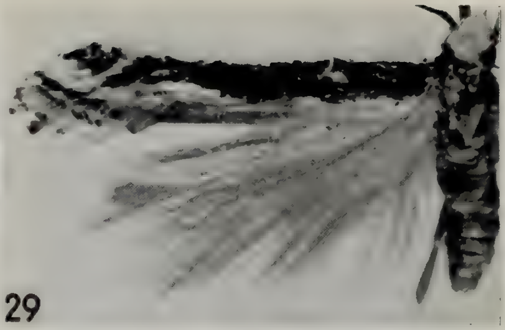

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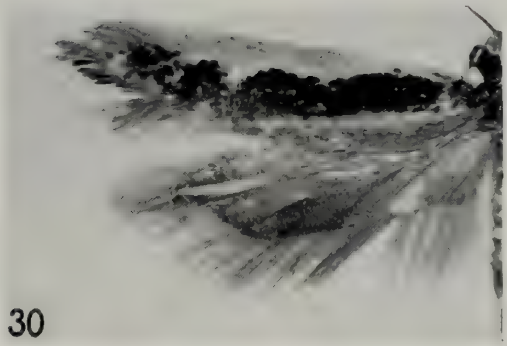

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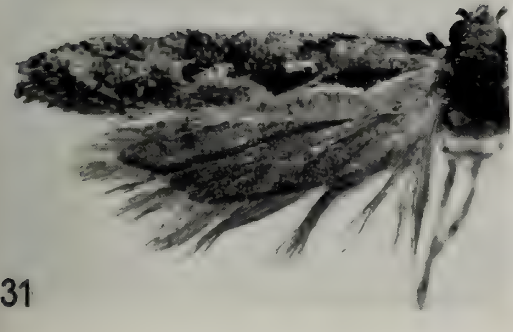

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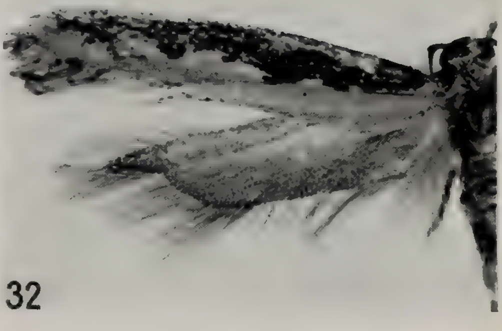
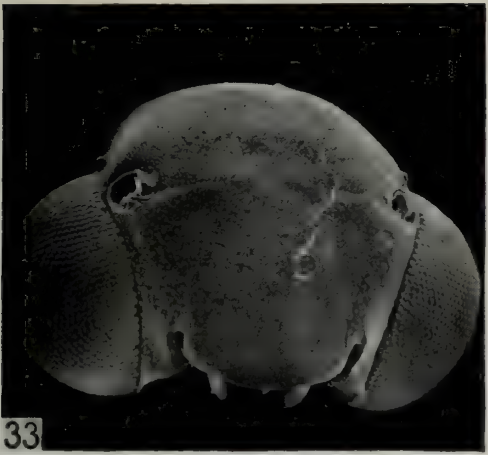


32

PLATE 5

Ornativalva heads; frontal, lateral and dorsal view

FIGS 33–35. *Ornativalva plutelliformis* (Staudinger). ♀. Sudan. (BMNH.)
FIGS 36–38. *O. erubescens* (Walsingham). ♀. Sudan. (BMNH.)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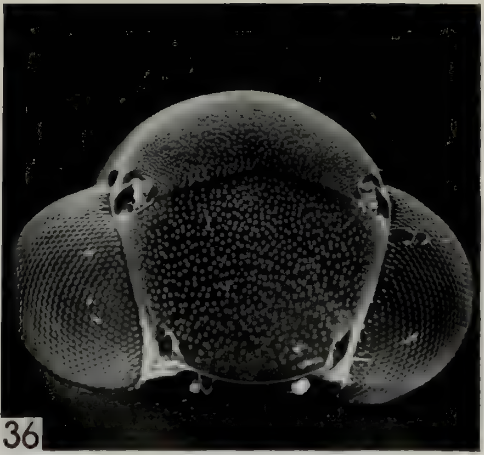
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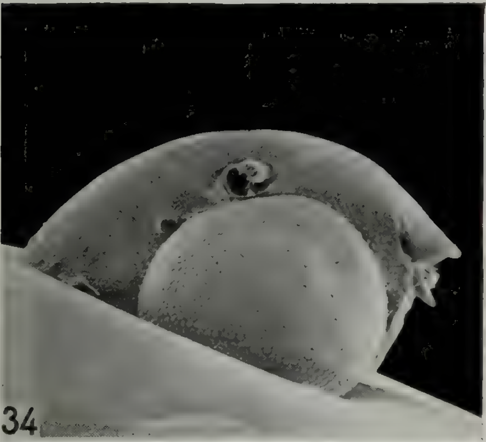
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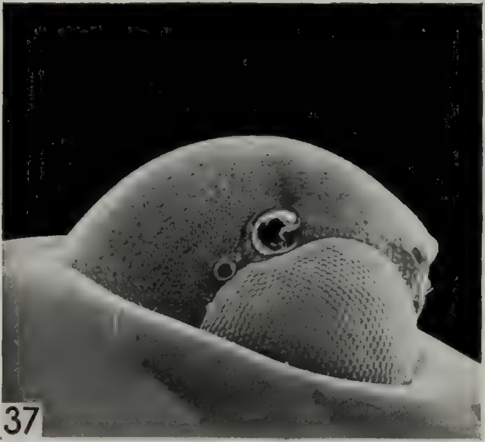
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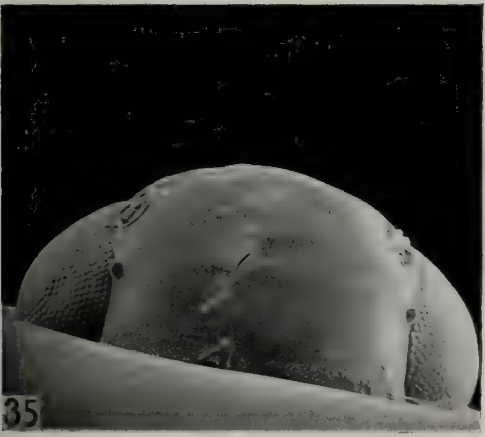
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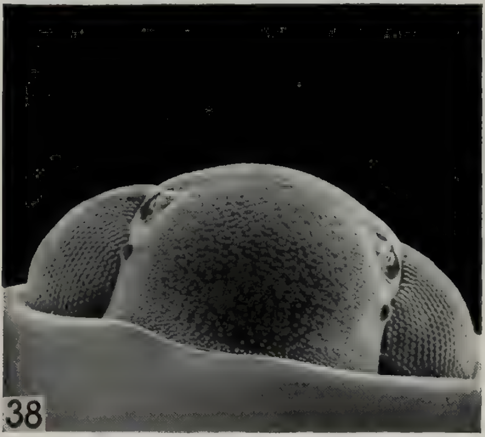
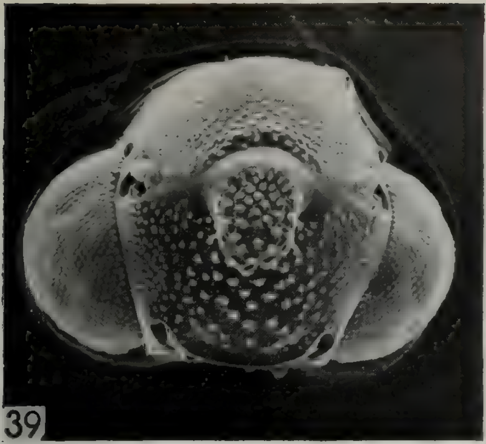

38

PLATE 6

Ornativalva heads; frontal, lateral and dorsal view

FIGS 39–41. *Ornativalva lilyella* (Lucas). ♂. Algeria. (MNHN, Paris.)
FIGS 42–44. *O. aspera* sp. n. ♂, paratype. Mongolia. (TM, Budapest.)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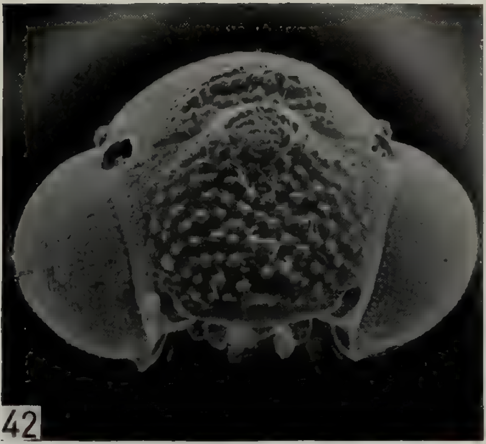
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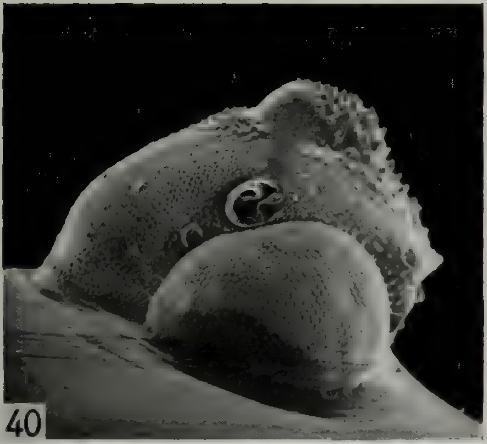
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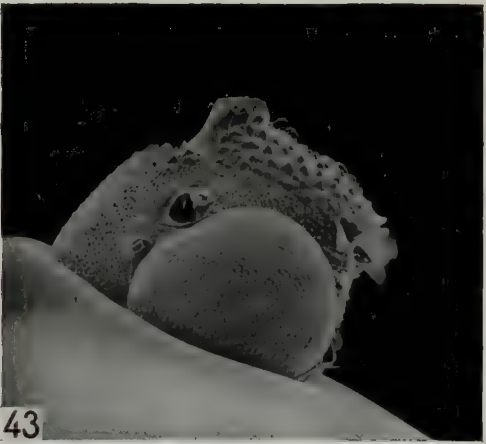
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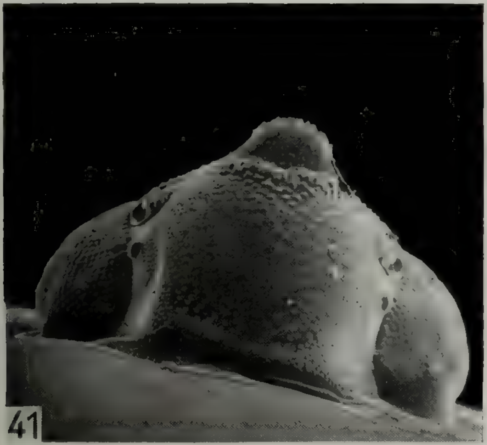
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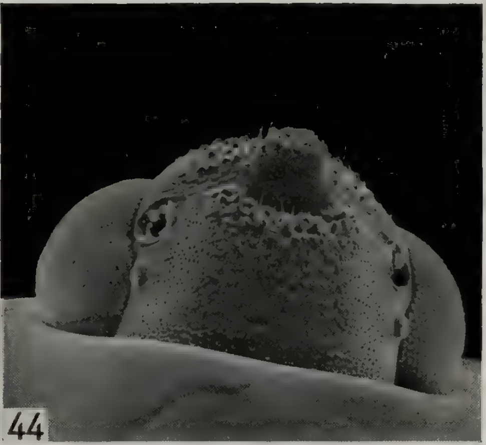
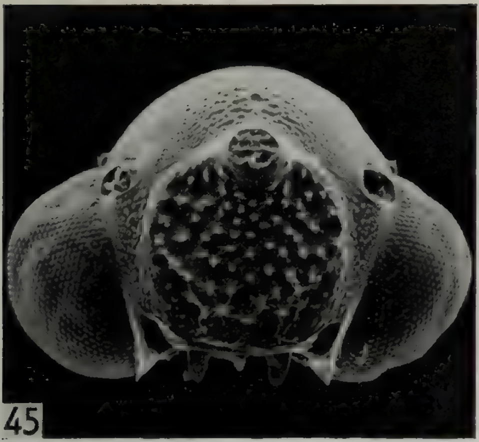

44

PLATE 7

Ornativalva heads; frontal, lateral and dorsal view

FIGS 45–47. *Ornativalva pulchella* sp. n. ♂, paratype. Mongolia. (BMNH.)
FIGS 48–50. *O. frontella* sp. n. ♂, paratype. Mongolia. (TM, Budapest.)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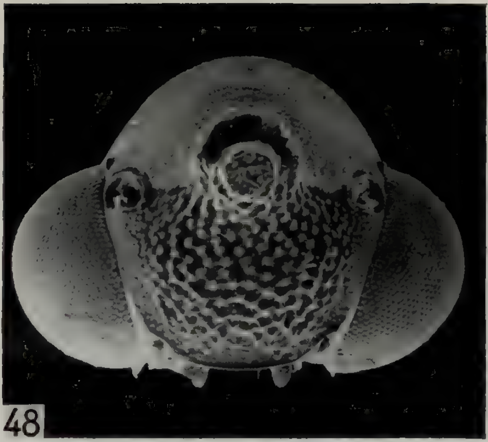
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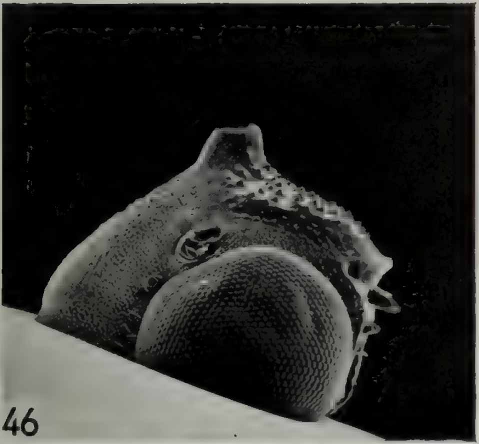
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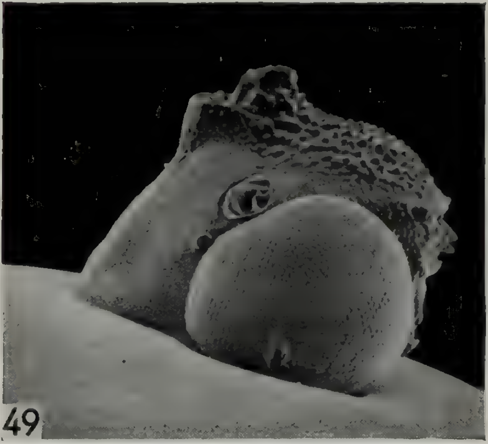
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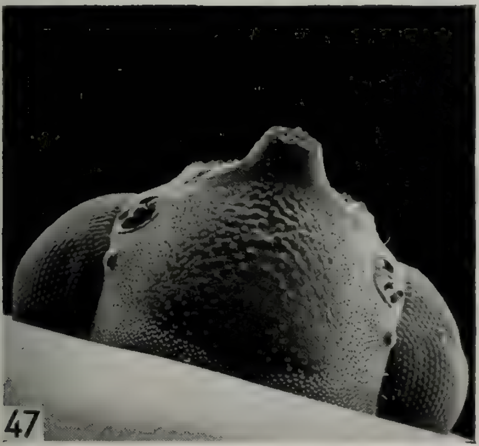
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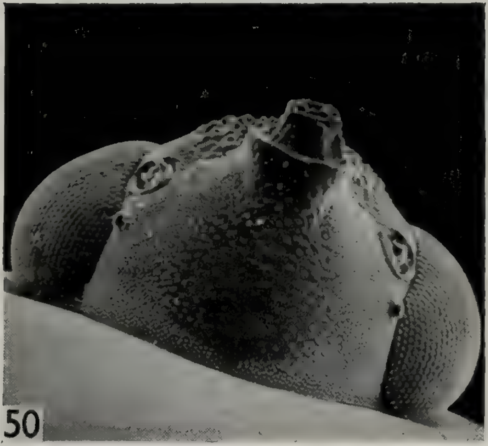
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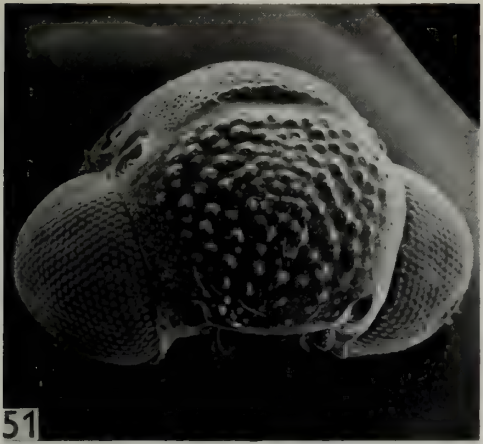
PLATE 8

Ornativalva heads; frontal, lateral and dorsal view

Figs 51–53. *Ornativalva mixolitha* (Meyrick). ♀. Sudan. (BMNH.)
Figs 54–56. *O. mixolitha* (Meyrick). ♀. Turkey. (BMNH.)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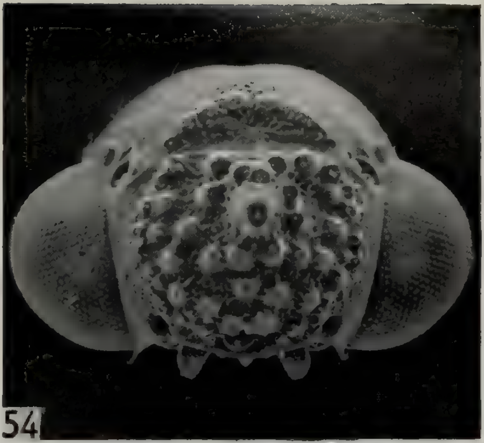
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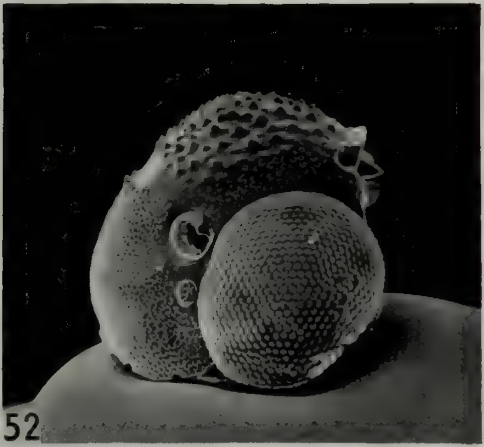
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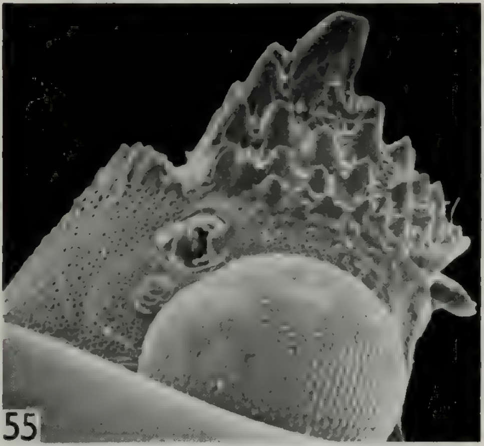
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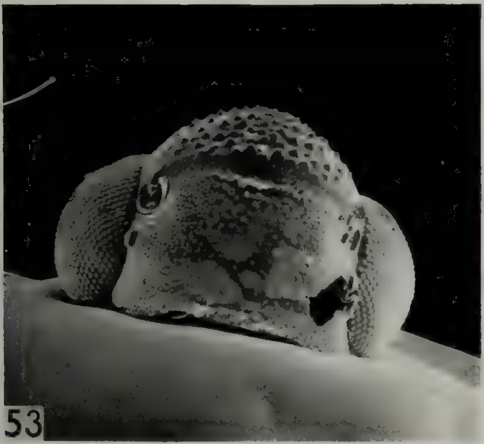
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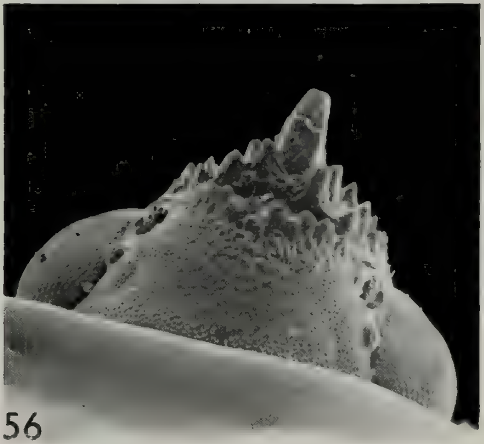
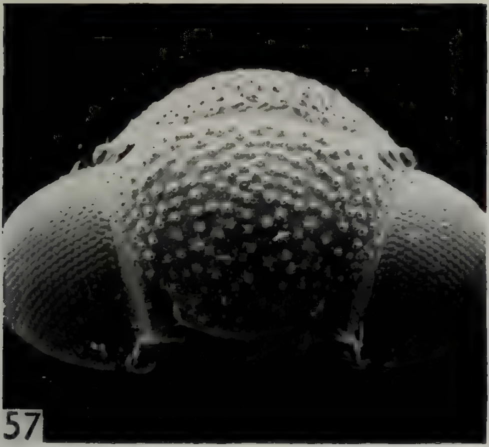

56

PLATE 9

Ornativalva heads; frontal, lateral and dorsal view

FIGS 57–59. *Ornativalva angulatella* (Chrétien). ♂. Algeria. (MNHN, Paris.)
FIGS 60–62. *O. cerostomatella* (Walsingham). ♀. Tunisia. (BMNH.)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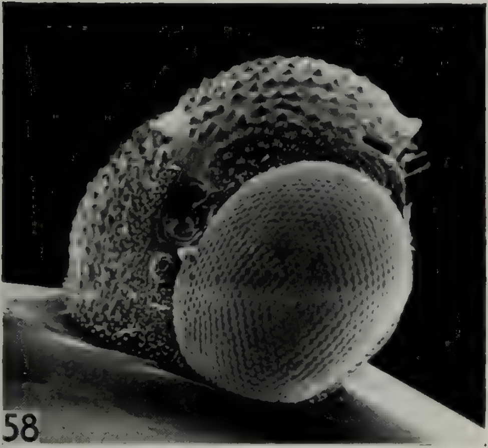
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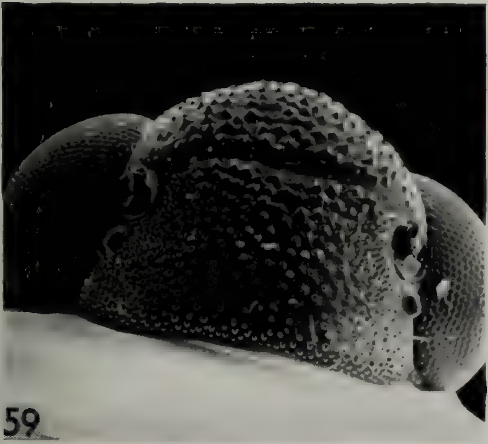
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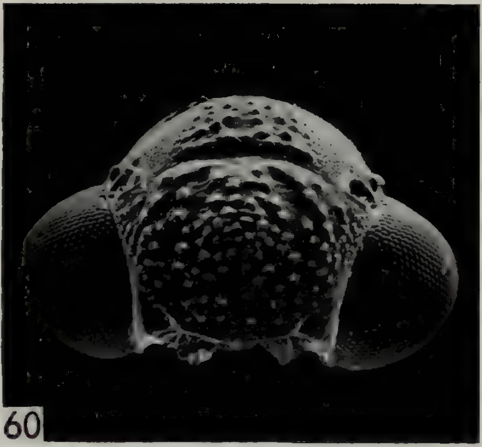
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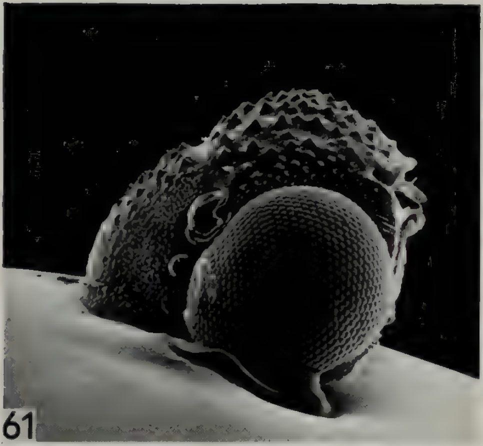
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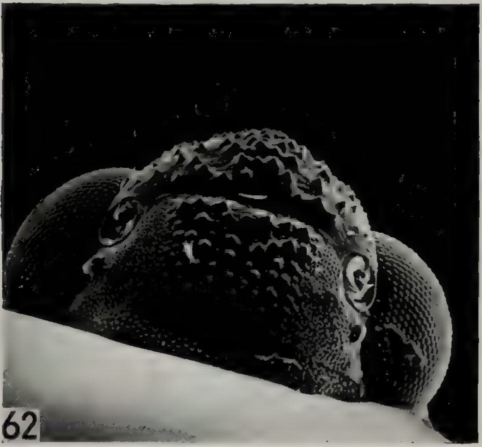
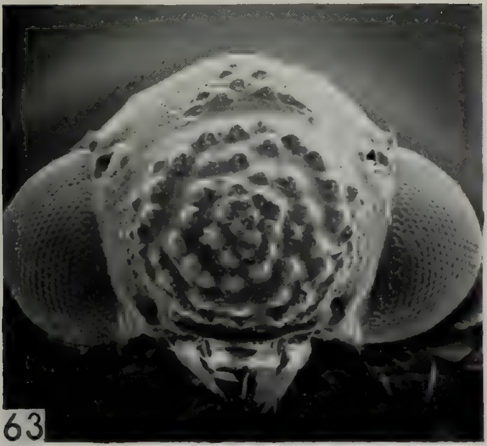

62

PLATE 10

Ornativalva heads; frontal, lateral and dorsal view

Figs 63–65. *Ornativalva mongolica* Sattler. ♂. Mongolia. (BMNH.)
Figs 66–68. *O. curvella* sp. n. ♂, holotype. Mongolia. (TM, Budapest.)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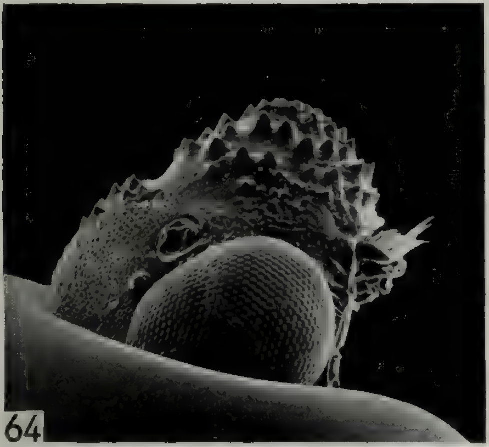
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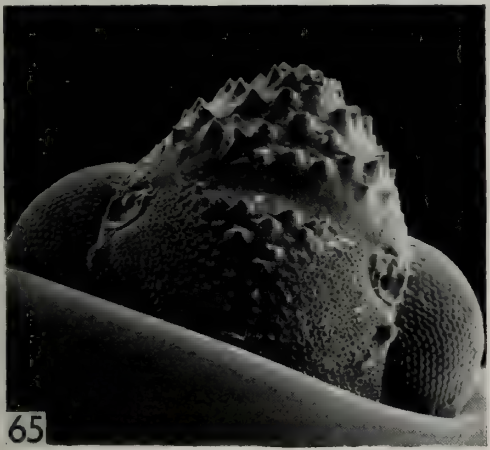
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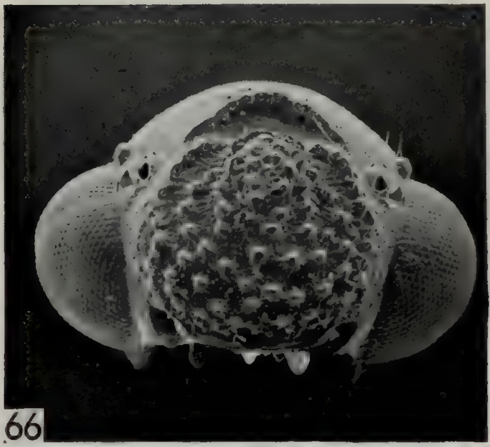
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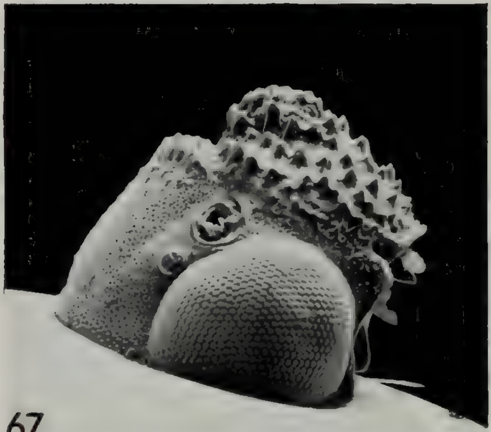
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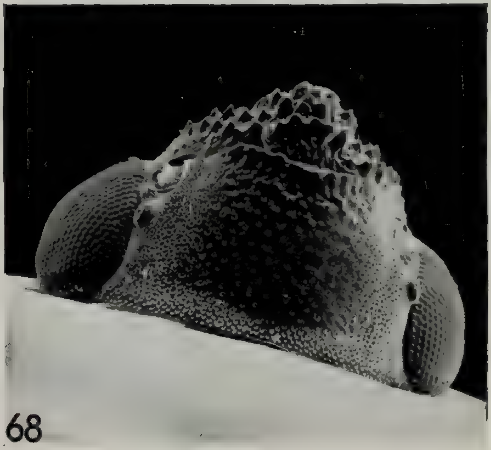
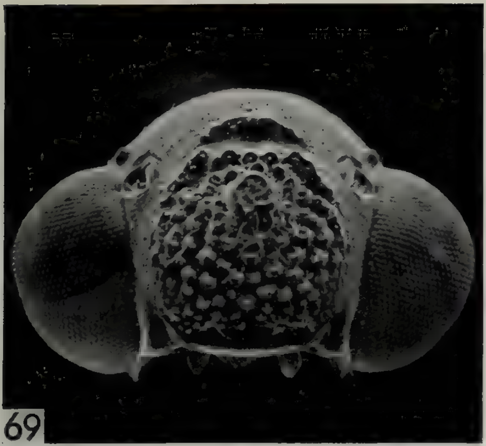

68

PLATE 11

Ornativalva heads; frontal, lateral and dorsal view

FIGS 69–71. *Ornativalva afghana* Sattler. ♀, paratype. Afghanistan. (BMNH.)
FIGS 72–74. *O. afghana* Sattler. ♂. Mongolia. (BMNH.)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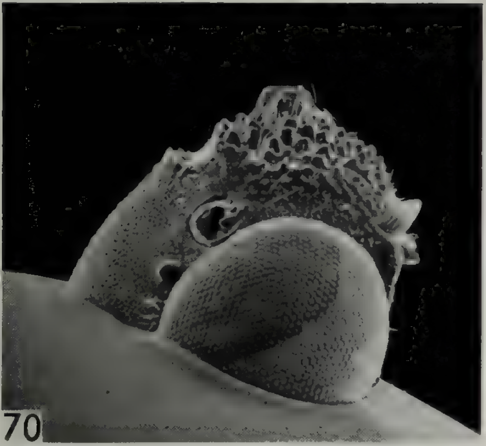
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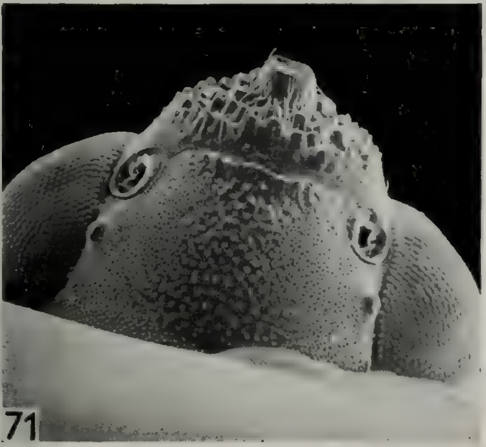
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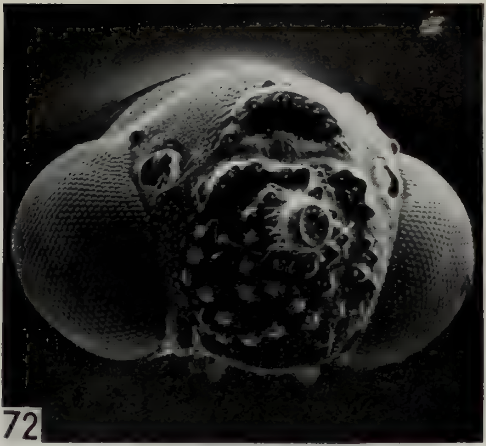
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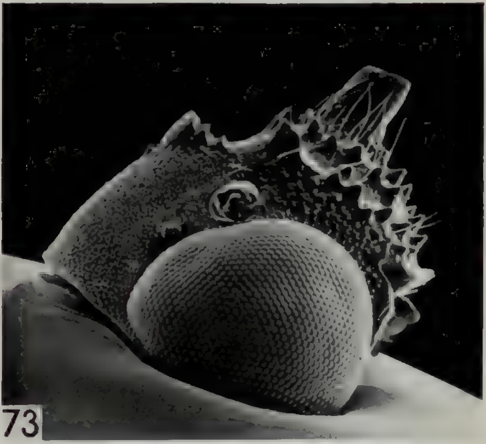
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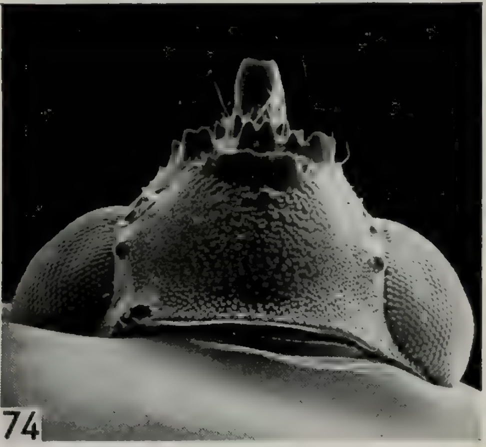
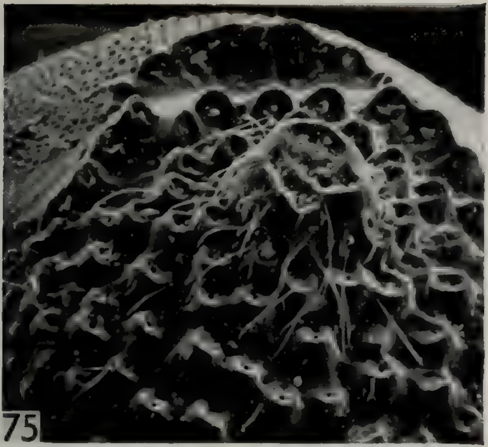

74

PLATE 12

Ornativalva head structures

FIG. 75. *Ornativalva afghana* Sattler. ♀, paratype. Afghanistan. (BMNH.) – Frontal process.
FIG. 76. *O. afghana* Sattler. ♀, paratype. Afghanistan. (BMNH.) – Modified scale of frons.
FIG. 77. *O. afghana* Sattler. ♀, paratype. Afghanistan. (BMNH.) – Section of modified scale of frons.
FIG. 78. *O. cornifrons* sp. n. ♂, paratype. Mongolia. (BMNH.) – Frontal view.
FIG. 79. *O. cornifrons* sp. n. ♂, paratype. Mongolia. (BMNH.) – Lateral view.
FIG. 80. *O. cornifrons* sp. n. ♂, paratype. Mongolia. (BMNH.) – Dorsal view.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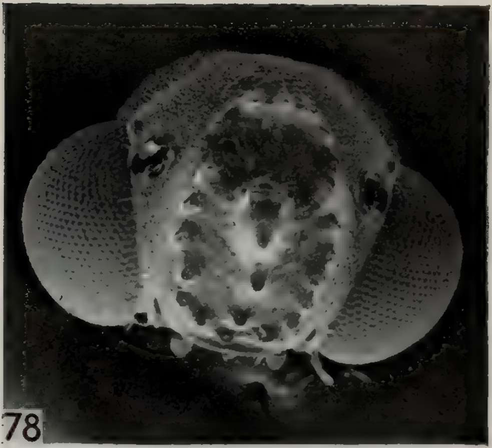
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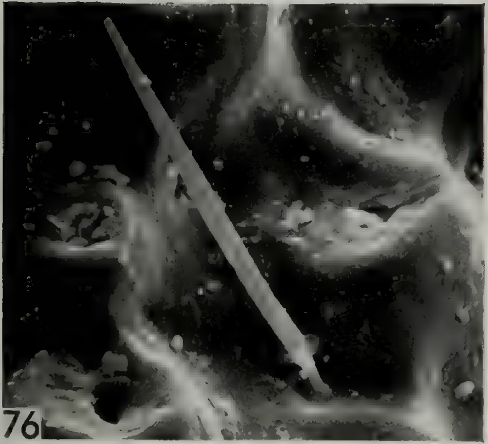
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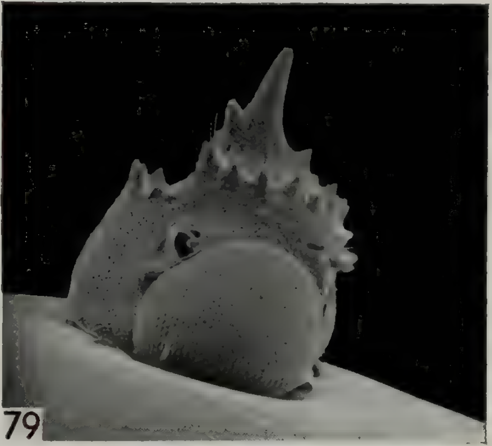
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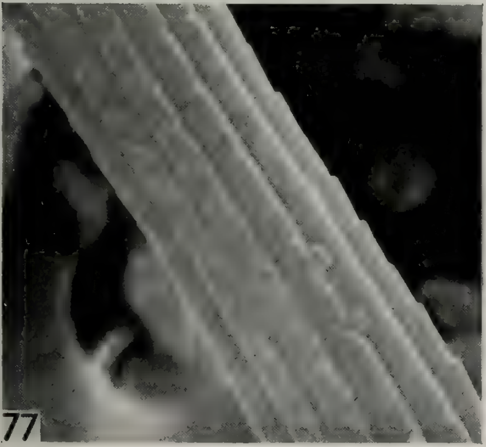
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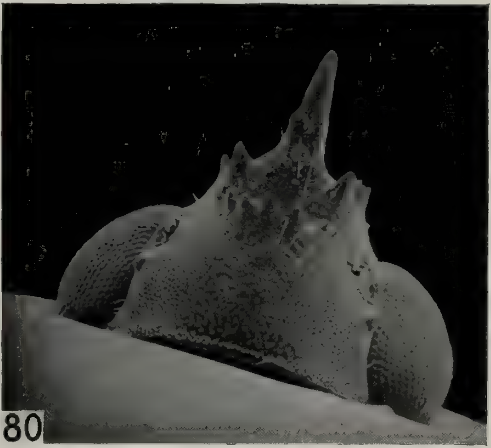
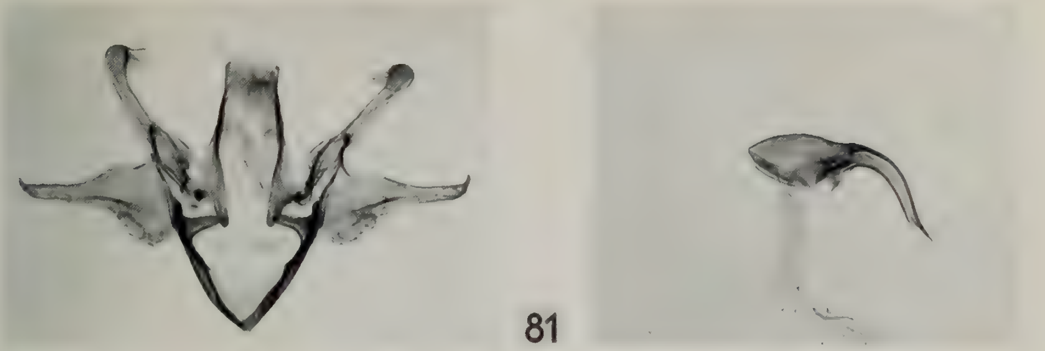

80

PLATE 13

Genitalia ♂

FIG. 81. *Ornativalva heluanensis* (Debski). Mongolia. (Slide no. 14 881, BMNH.)
FIG. 82. *O. longiductella* Sattler. Mongolia. (Slide no. 14 893, BMNH.)
FIG. 83. *O. rufipuncta* sp. n., paratype. Iran. (Slide no. 19 854, BMNH.)



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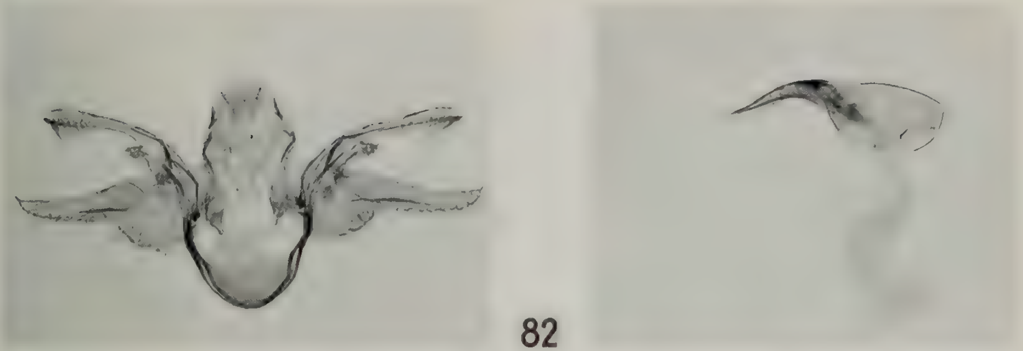

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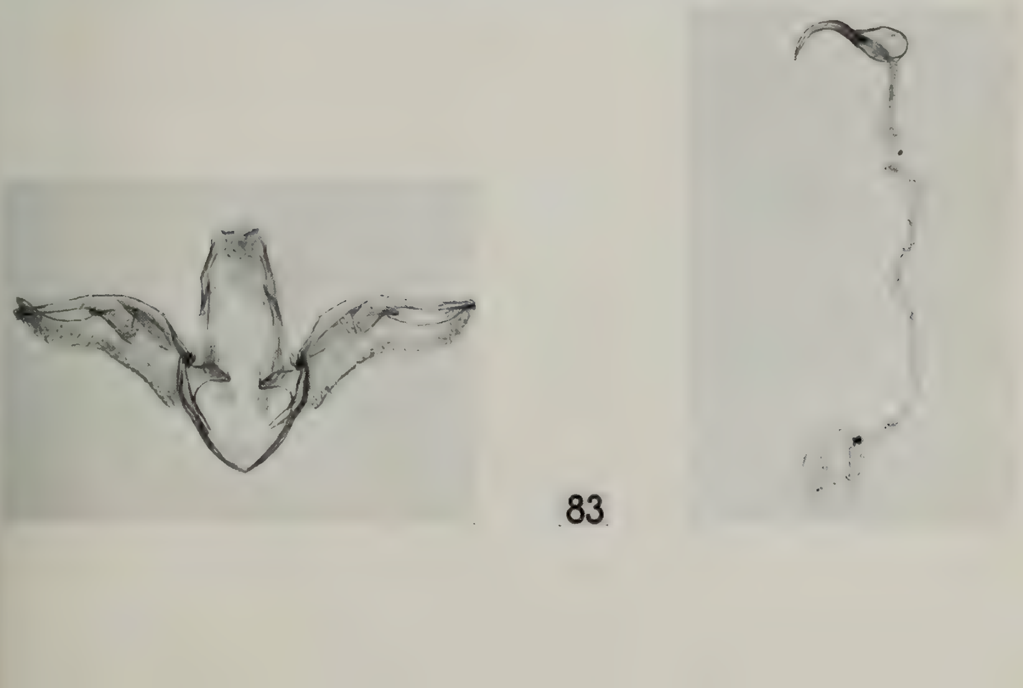

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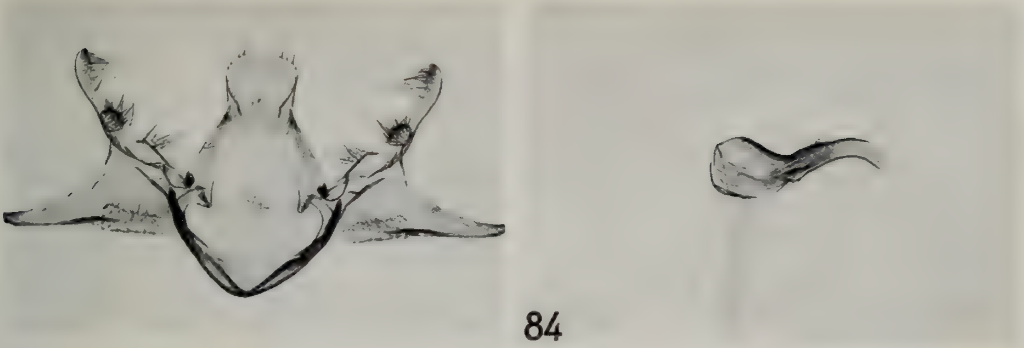
PLATE 14

Genitalia ♂

Fig. 84. *Ornativalva levifrons* sp. n., paratype. Mongolia. (Slide no. 15 382, BMNH.)
Fig. 85. *O. aspera* sp. n., paratype. Mongolia. (Slide no. 14 896, BMNH.)
Fig. 86. *O. pulchella* sp. n., holotype. Mongolia. (Slide no. 635d, Sattler; TM, Budapest.)



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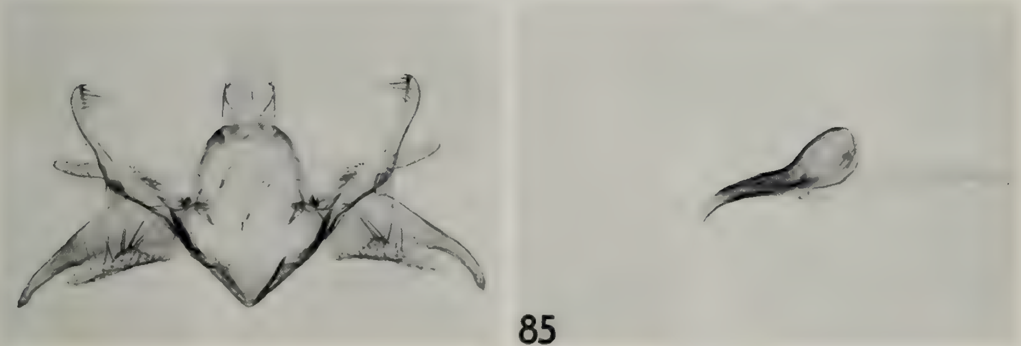

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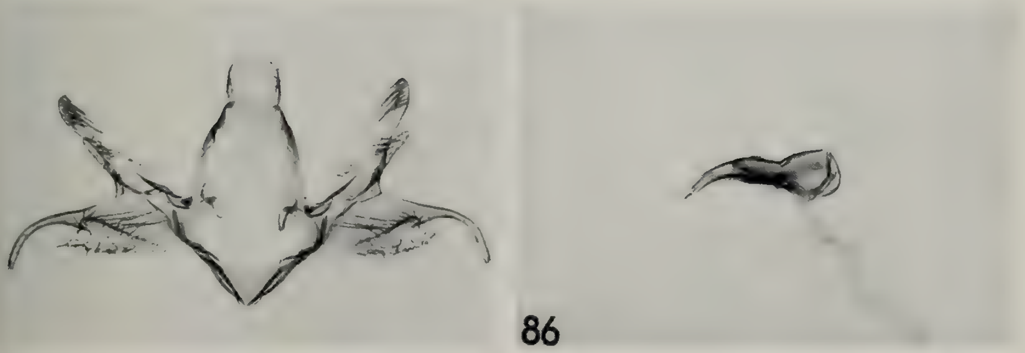

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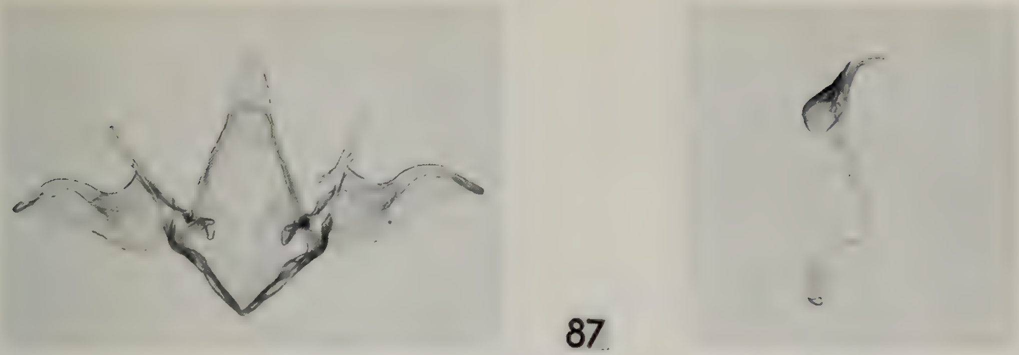
PLATE 15

Genitalia ♂

FIG. 87. *Ornativalva ochraceofusca* Sattler. Turkey. (Slide no. 3868, NM, Vienna.)
FIG. 88. *O.* species 1. Mongolia. (Slide no. 15 784, BMNH.)
FIG. 89. *O.* species 2. Mongolia. (Slide no. 656, Sattler; TM, Budapest.)



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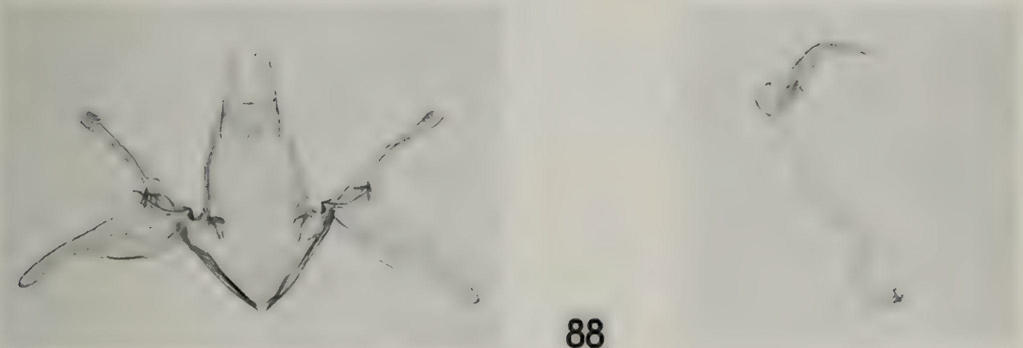

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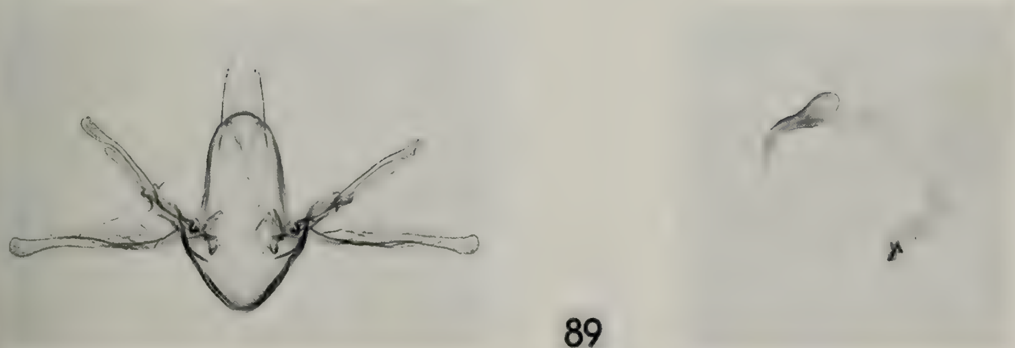

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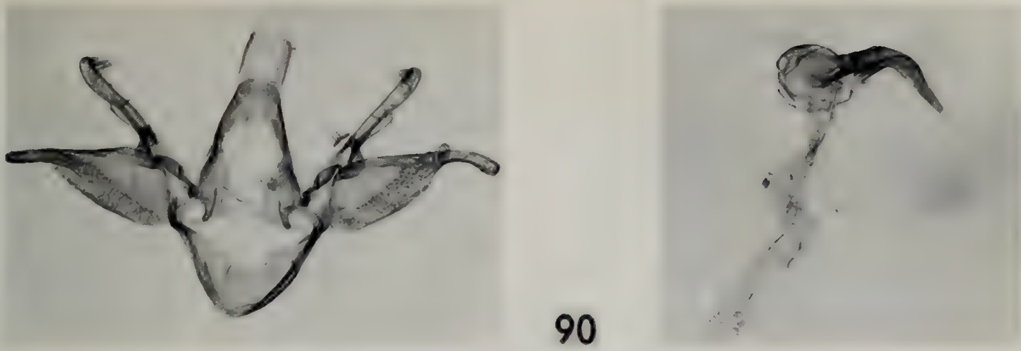
PLATE 16

Genitalia ♂

FIG. 90. *Ornativalva* species 3. Mongolia. (Slide no. 636d, Sattler; TM, Budapest.)
FIG. 91. *O. frontella* sp. n., paratype. Mongolia. (Slide no. 15 380, BMNH.)
FIG. 92. *O. ornatella* Sattler. Mongolia. (Slide no. 14 878, BMNH.)



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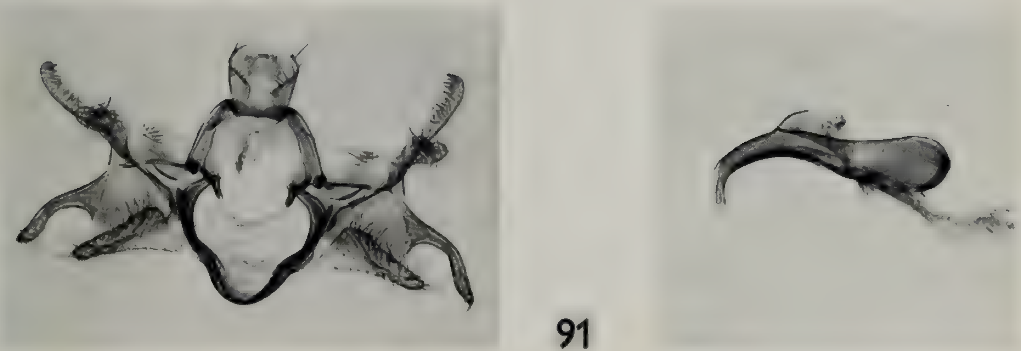

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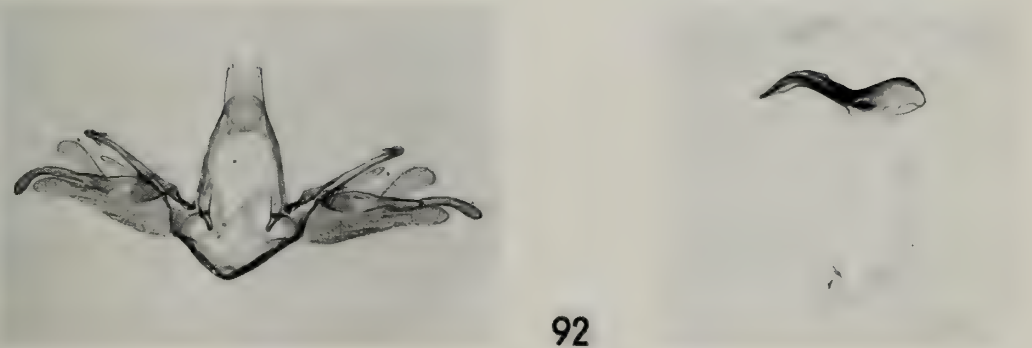

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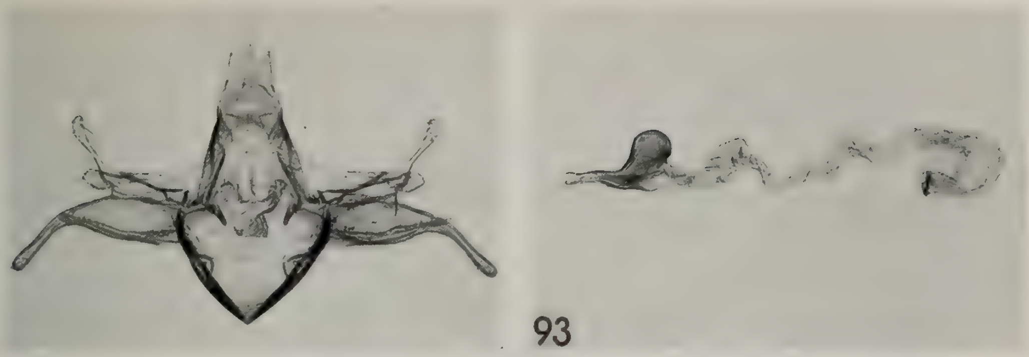
PLATE 17

Genitalia ♂

FIG. 93. *Ornativalva plicella* sp. n., paratype. Iran. (Slide no. 19 855, BMNH.)
FIG. 94. *O. misma* sp. n., holotype. Sudan. (Slide no. 19 841, BMNH.)
FIG. 95. *O. serratisignella* Sattler. Iran. (Slide no. 19 850, BMNH.)



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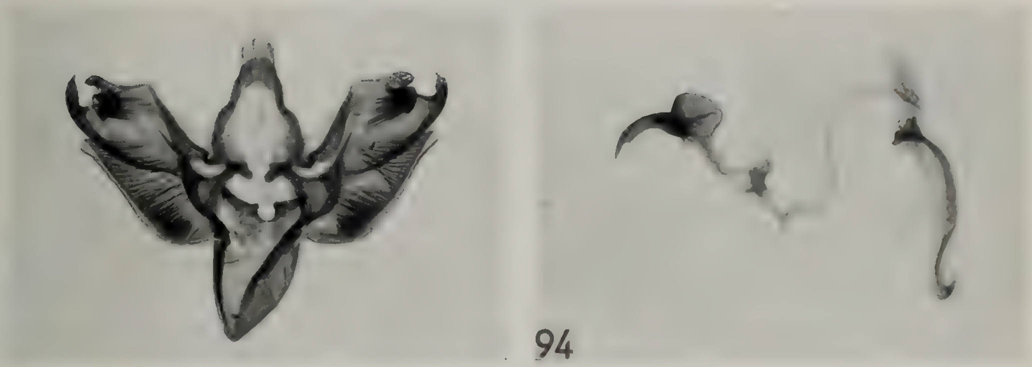

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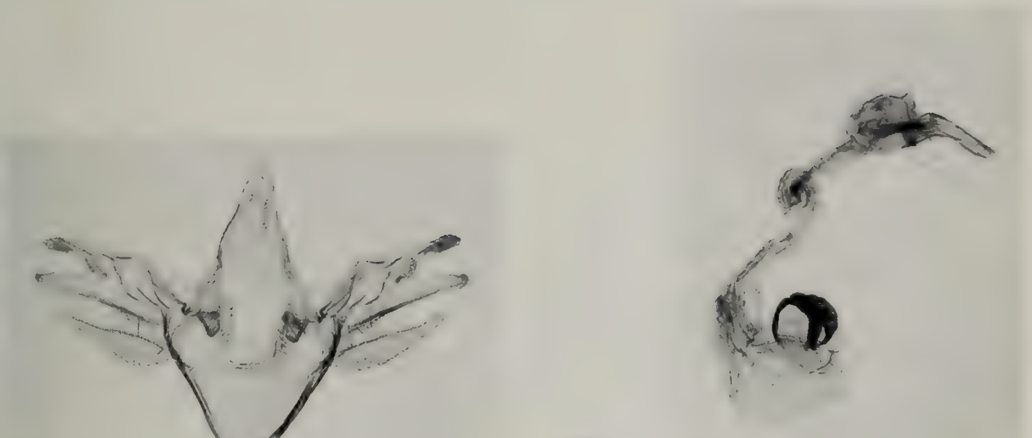

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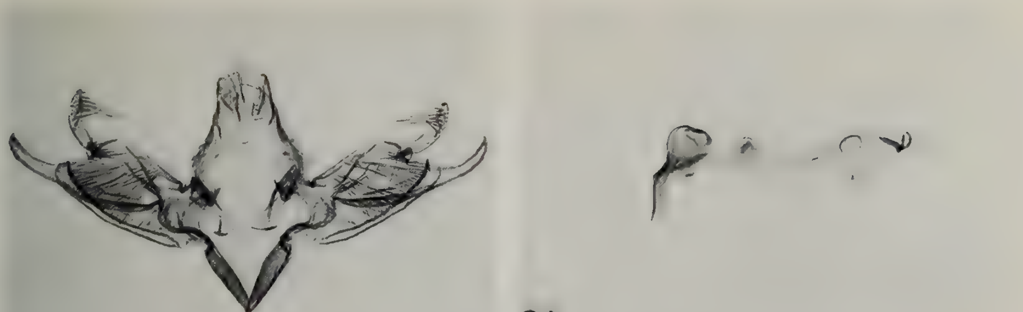
PLATE 18

Genitalia ♂

FIG. 96. *Ornativalva caecigena* (Meyrick). Kuwait. (Slide no. 18 890, BMNH.)
FIG. 97. *O.* species 5. Iran. (Slide no. 3882, NM, Vienna.)
FIG. 98. *O. singula* Sattler. Mongolia. (Slide no. 14 889, BMNH.)



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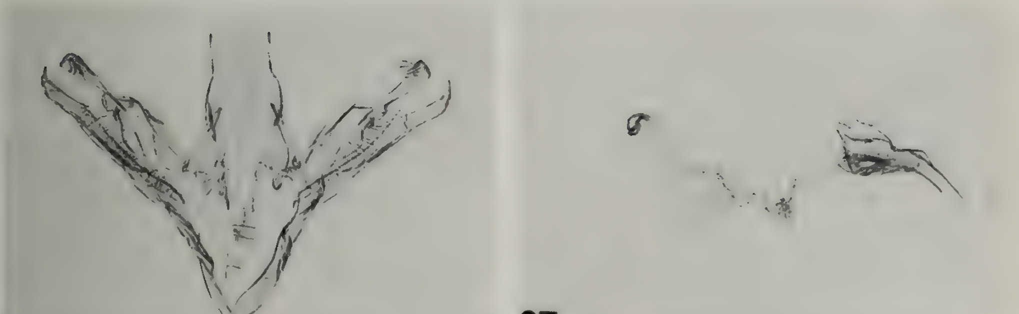

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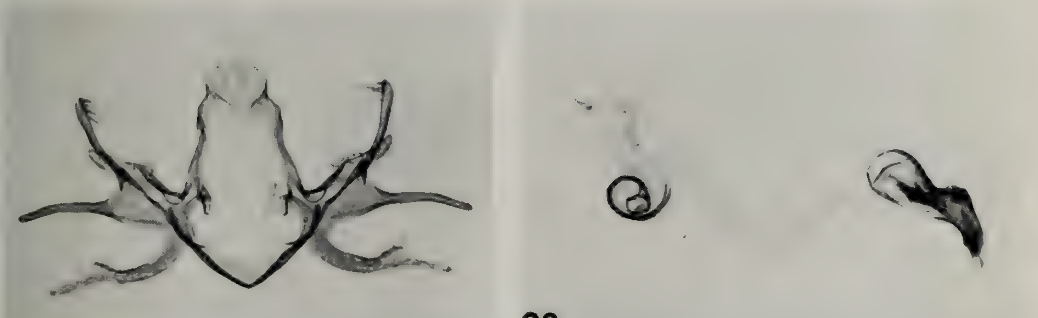

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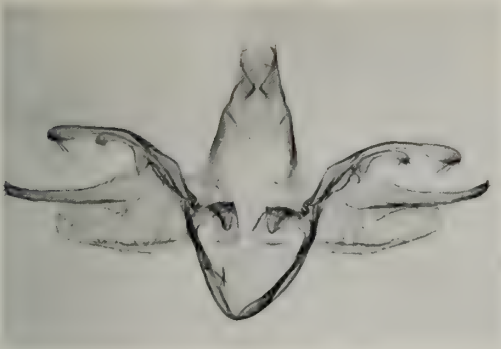
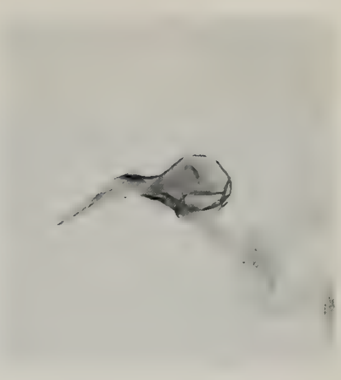
PLATE 19

Genitalia ♂

FIG. 99. *Ornativalva basistriga* sp. n., paratype. Mongolia. (Slide no. 14 874, BMNH.)
FIG. 100. *O.* species 6. Mongolia. (Slide no. 14 888, BMNH.)
FIG. 101. *O. cornifrons* sp. n., paratype. Mongolia. (Slide no. 15 730, BMNH.)

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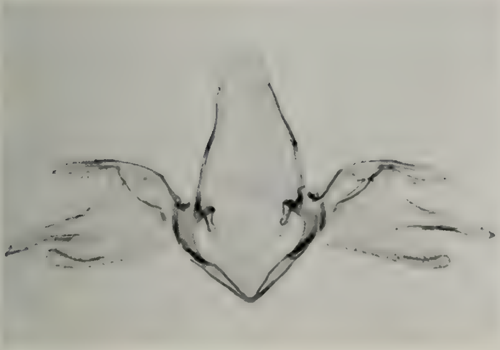

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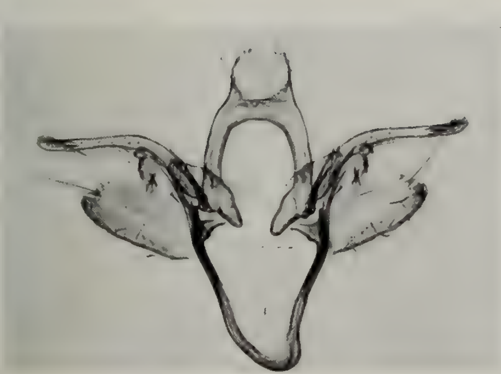
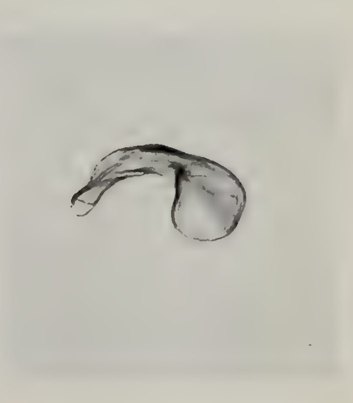

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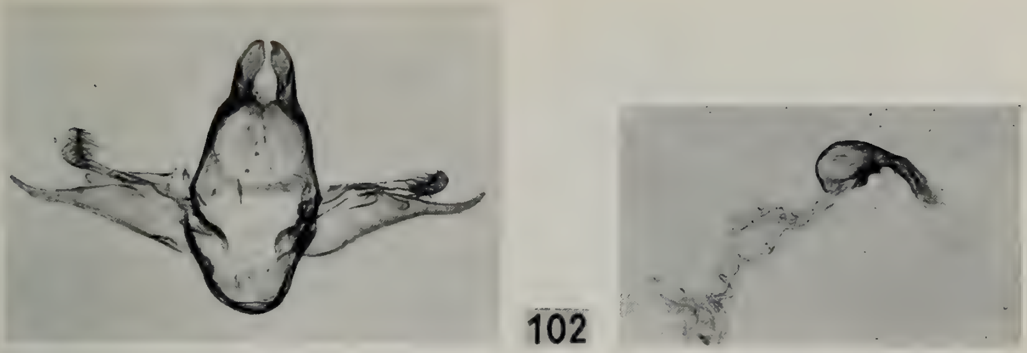
PLATE 20

Genitalia ♂

FIG. 102. *Ornativalva afghana* Sattler. Mongolia. (Slide no. 15 378, BMNH.)
FIG. 103. *O. curvella* sp. n., holotype. Mongolia. (Slide no. 647d, Sattler; TM, Budapest.)
FIG. 104. *O. acutivalva* sp. n., paratype. Mongolia. (Slide no. 14 882, BMNH.)



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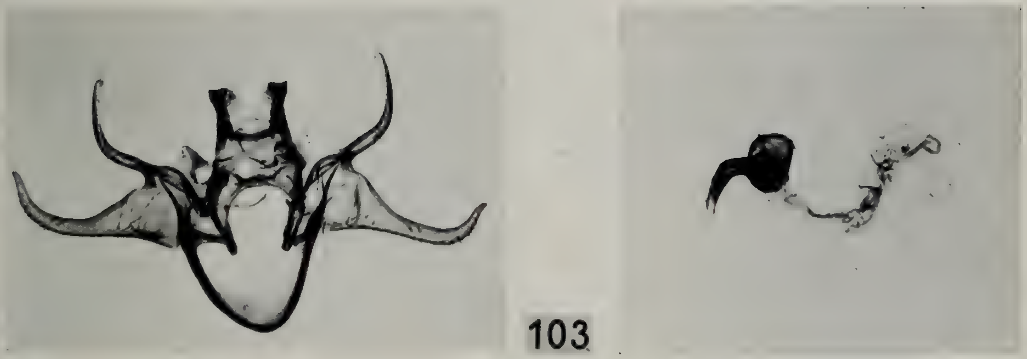

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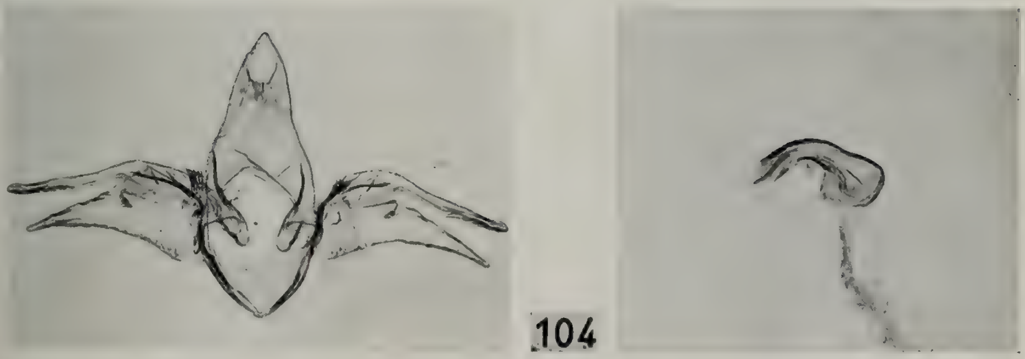

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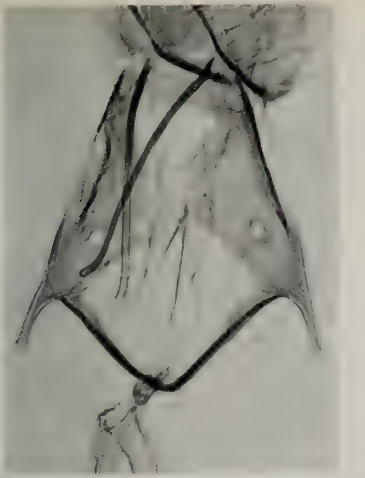
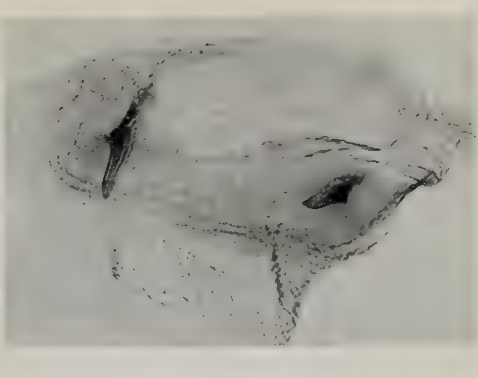
PLATE 21

Genitalia ♀

FIG. 105. *Ornativalva heluanensis* (Debski). Mongolia. (Slide no. 637d, Sattler; TM, Budapest.)
FIG. 106. *O. rufipuncta* sp. n., paratype. Iran. (Slide no. 3885, NM, Vienna.)
FIG. 107. *O. levifrons* sp. n., paratype. Mongolia. (Slide no. 15 379, BMNH.)





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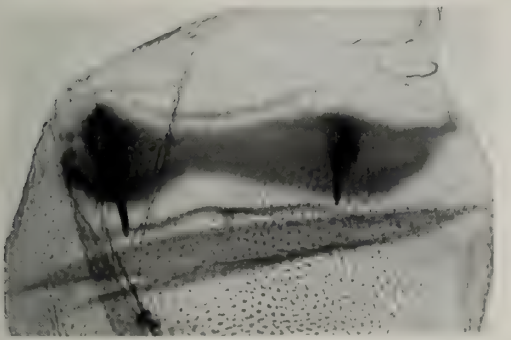

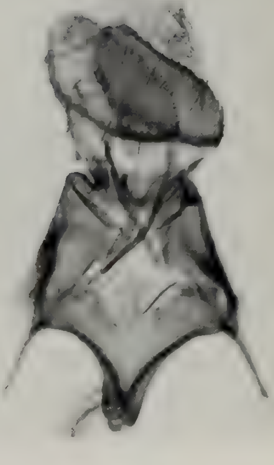

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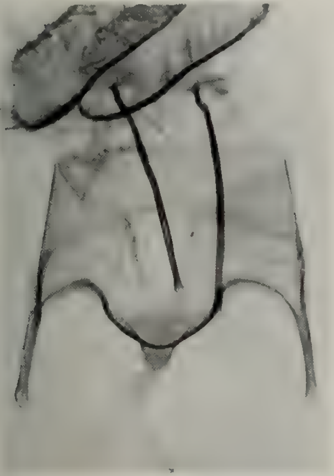

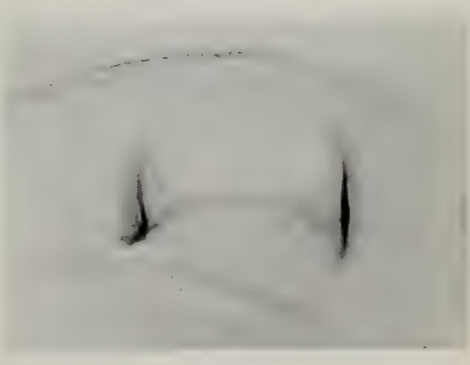

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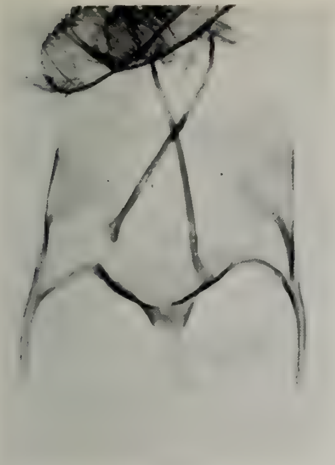
PLATE 22

Genitalia ♀

Fig. 108. *Ornativalva aspera* sp. n., paratype. Mongolia. (Slide no. 14 877, BMNH.)
Fig. 109. *O. pulchella* sp. n., paratype. Mongolia. (Slide no. 14 869, BMNH.)
Fig. 110. *O. ochraceofusca* Sattler. Afghanistan. (Slide no. 15 787, BMNH.)



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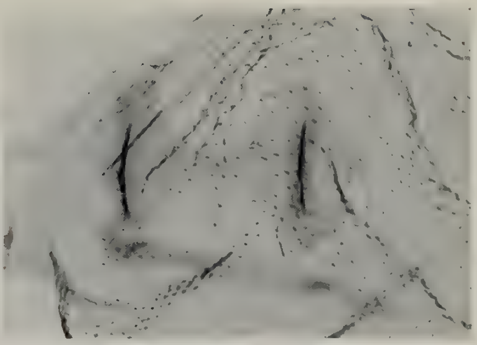

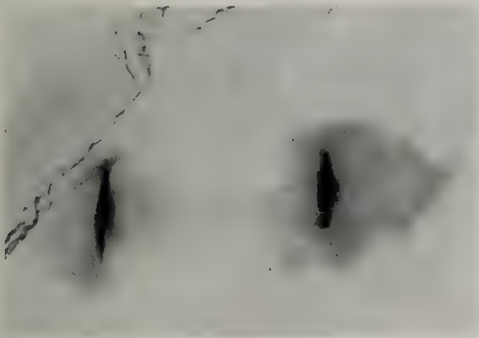

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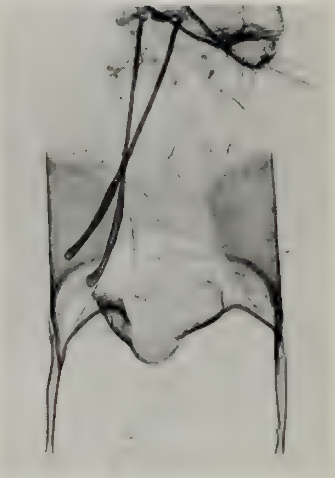

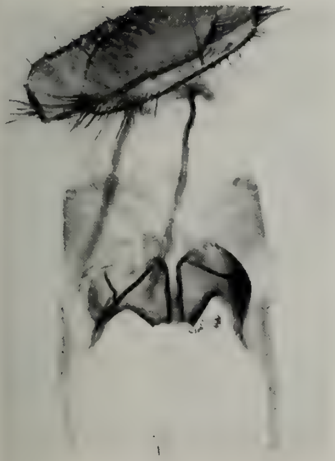

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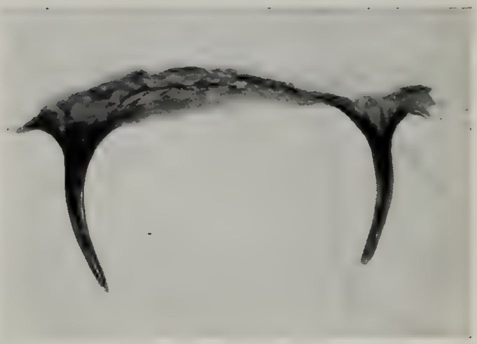
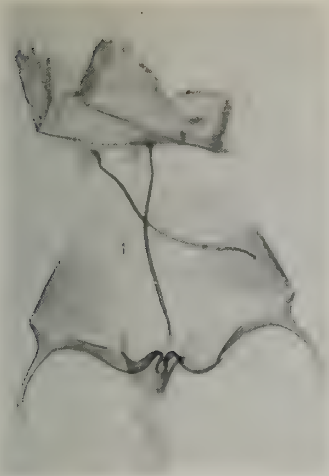


PLATE 23

Genitalia ♀

FIG. 111. *Ornativalva* species 1. Mongolia. (Slide no. 650, Sattler; TM, Budapest.)
FIG. 112. *O. ignota* Sattler. Algeria. (Slide no. 6267, BMNH.)
FIG. 113. *O. ornatella* Sattler. Mongolia. (Slide no. 14 875, BMNH.)



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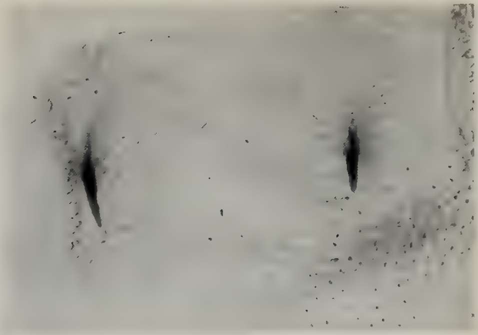

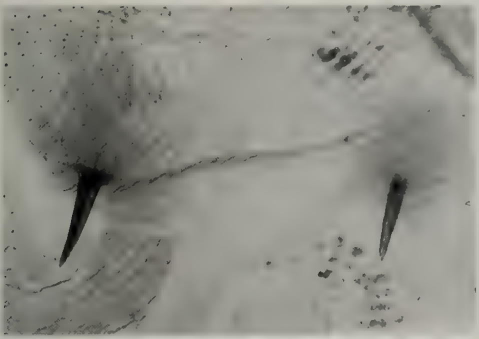

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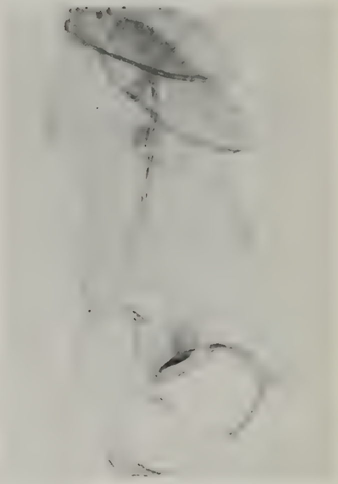

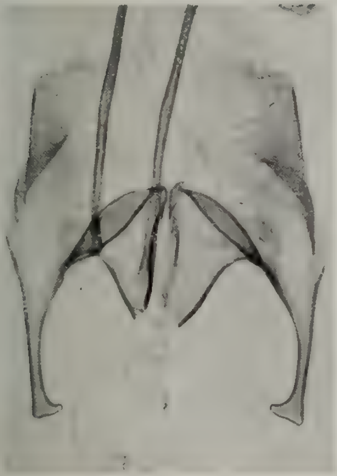

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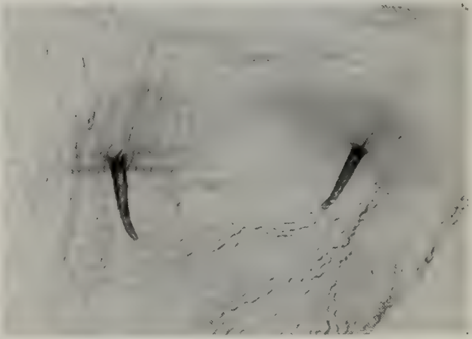
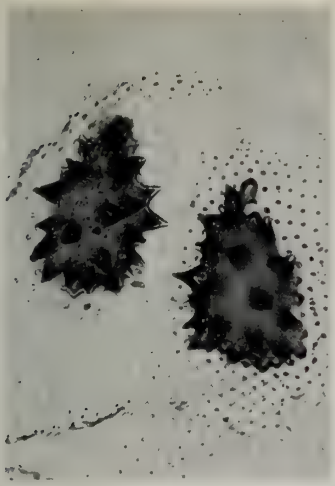


PLATE 24

Genitalia ♀

FIG. 114. *Ornativalva plicella* sp. n., paratype. Iran. (Slide no. 18 952, BMNH.) Signa and sclerotization of cervix bursae separate.

FIG. 115. *O. undella* sp. n., holotype. Iran. (Slide no. 3864, NM, Vienna.) Signa and sclerotization of cervix bursae separate.



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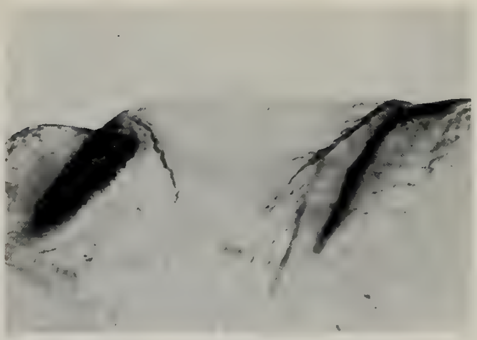

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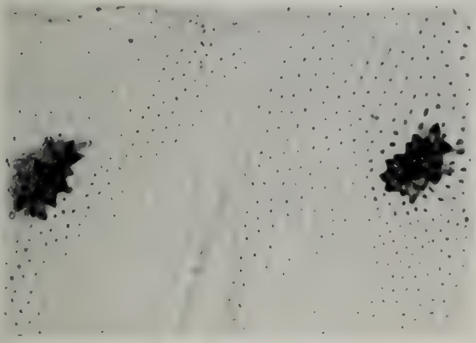

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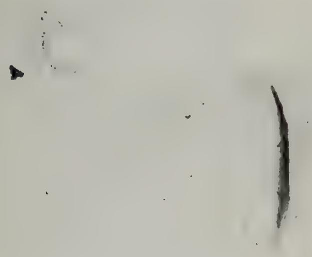


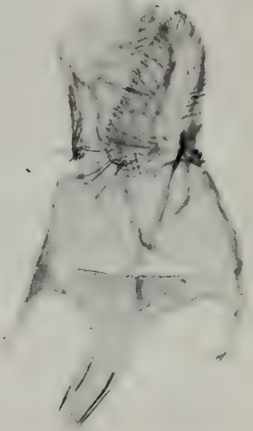
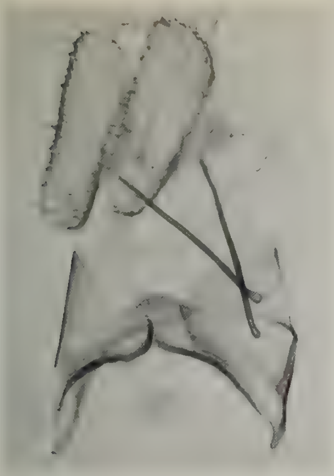


PLATE 25

Genitalia ♀

Fig. 116. *Ornativalva* species 4. Mongolia. (Slide no. 15 783, BMNH.)
Fig. 117. *O. misma* sp. n., paratype. Sudan. (Slide no. 19 842, BMNH.)
Fig. 118. *O.* species 5. Iran. (Slide no. 3865, NM, Vienna.)



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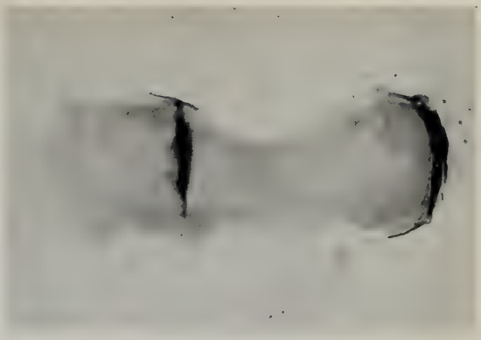

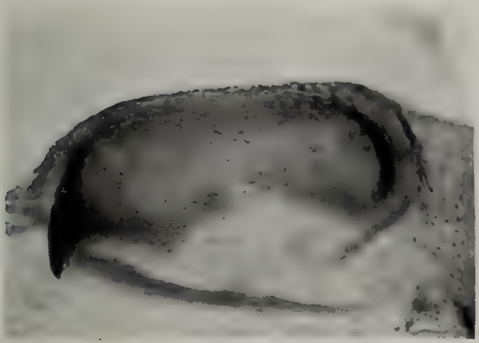

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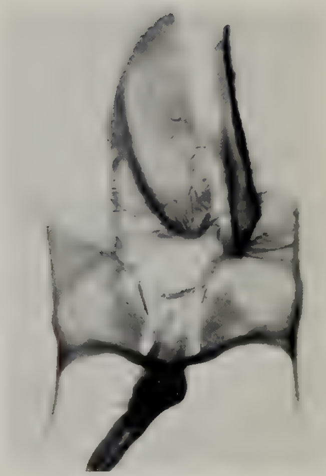

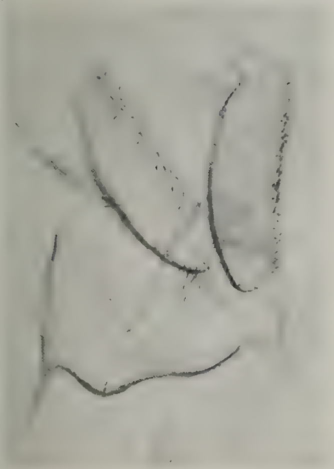

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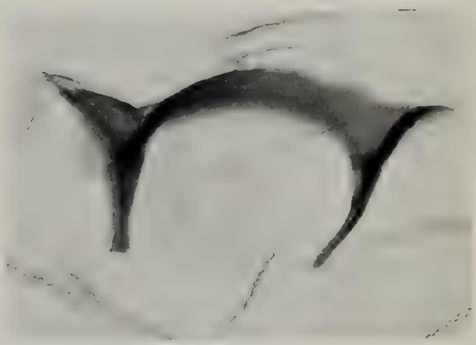
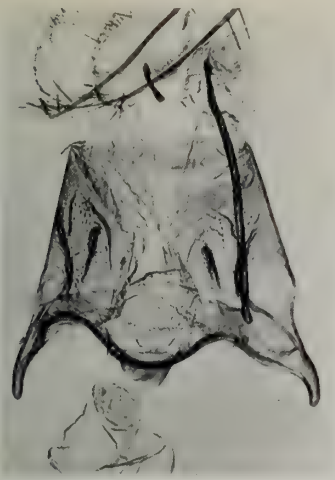
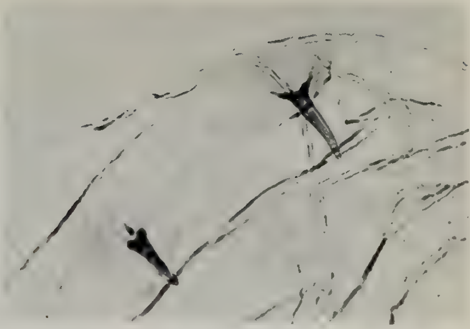


PLATE 26

Genitalia ♀

FIG. 119. *Ornativalva singula* Sattler. Mongolia. (Slide no. 15 731, BMNH.)
FIG. 120. *O. basistriga* sp. n., paratype. Mongolia. (Slide no. 645d, Sattler; TM, Budapest.)
FIG. 121. *O.* species 6. Mongolia. (Slide no. 636c, Sattler; TM, Budapest.)





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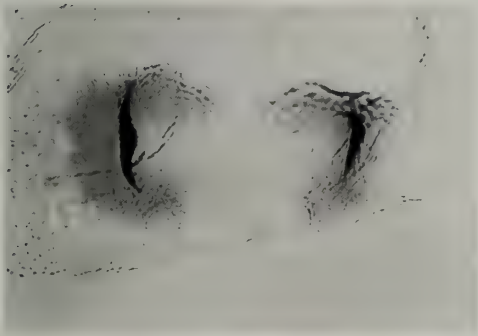

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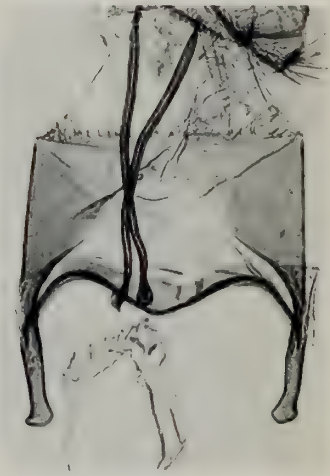

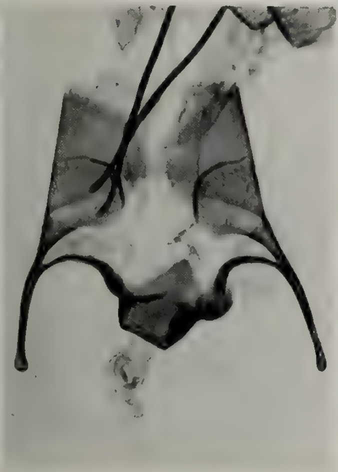

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PLATE 27

Genitalia ♀

FIG. 122. *Ornativalva mixolitha* (Meyrick). Mongolia. (Slide no. 635c, Sattler; TM, Budapest.) Ventral and dorsal surface of eighth segment.

FIG. 123. *O. cornifrons* sp. n., paratype. Mongolia. (Slide no. 14 891, BMNH.)

FIG. 124. *O. afghana* Sattler. Mongolia. (Slide no. 637b, Sattler; TM, Budapest.)

FIG. 125. *O. acutivalva* sp. n., paratype. Mongolia. (Slide no. 14 894, BMNH.)

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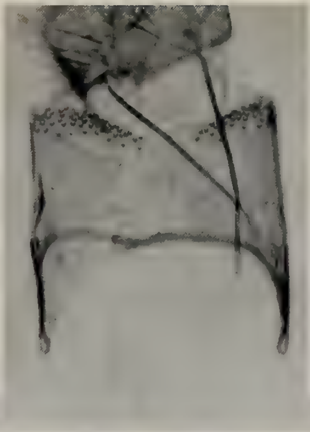
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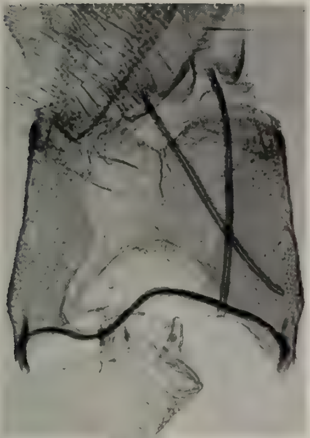
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ENTOMOLOGY Vol. 34 No. 3
LONDON : 1976

THE TAXONOMY OF THE GENUS *HETEROPELMA* WESMAEL (HYMENOPTERA : ICHNEUMONIDAE)

BY

IAN DAVID GAULD
Commonwealth Institute of Entomology

Pp. 153–219; 64 *Text-figures;* 3 *Charts;* 2 *Maps*

BULLETIN OF
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ENTOMOLOGY Vol. 34 No. 3
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THE TAXONOMY OF THE GENUS *HETEROPELMA* WESMAEL (HYMENOPTERA : ICHNEUMONIDAE)

By I. D. GAULD

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SYNOPSIS

The genus *Heteropelma* is defined and *Tanypelma* is included as a synonym of it. Seventeen species are recognized, four of which are new. Fifteen specific names are reduced to synonyms and one new combination is made. Six lectotype designations are made. All species are keyed and redescribed and notes on the distribution and biology, where known, are included. Intraspecific variation is discussed at length for some widely distributed species. The interspecific relationships are discussed from both phenetic and phylogenetic standpoints.

INTRODUCTION

Heteropelma is a moderate-sized genus belonging to the tribe Therionini of the subfamily Anomaloninae. Species have been recorded from all regions except the Ethiopian, but the majority of species occur on high ground in the Indo-Papuan region. Although host records are scarce certain species have repeatedly been recorded as parasites of pest species of Lepidoptera and thus several species of *Heteropelma* are insects of economic importance. As far as is known species of this genus are only parasitic on lepidopterous larvae, especially those of the Noctuoidea, Geometroidea and Sphingoidea. Oviposition is usually into early instar larvae.

The ichneumonid completes development in the host puparium and the adult invariably emerges by biting off the extreme anterior end of the host puparium.

Previous studies on this genus are mostly represented by scattered descriptions of new species and less often by keys to species of a particular region. Morley (1913*a*) included a key to world species represented in the collections of the British Museum (Natural History), but unfortunately he confused *Heteropelma* with other genera, thereby considerably reducing the value of his work. Schmiedeknecht (1936) and Uchida (1958) included useful keys to western and eastern Palaearctic species respectively. In these and all earlier works species now placed in *Heteropelma* were divided between two genera, *Heteropelma* and *Schizoloma*. As a result of examining some intermediate species Townes (1971) synonymized *Schizoloma* with *Heteropelma*.

A number of synonyms have been created because of the wide range of geographical distribution of several species. No attempt has been made by earlier authors to ascertain the range of variation occurring in the several species. The present paper is an attempt to delimit the known species more accurately and to give some insight into the range of variation, distribution and habits of members of this interesting genus.

NOMENCLATURAL SUMMARY

Townes and co-workers (1951; 1961; 1965) catalogued 27 species as either *Heteropelma* or *Schizoloma*. At the start of this work 25 were considered to be valid species, two having been reduced to synonyms by Gauld (1974). The nomenclatural changes made in the present work are summarized below.

HETEROPELMA Wesmael, 1849
    Schizoloma Wesmael, 1849
    Tanypelma Townes, 1971 **syn. n.**
  calcator Wesmael, 1849
  fulvitarse Cameron, 1899
    reticulatum Cameron, 1899 **syn. n.**
    binghami Cameron, 1907 **syn. n.**
    grossator Shestakov, 1923 **syn. n.**
    perlongum Cushman, 1937 **syn. n.**
    panargis Heinrich, 1953 **syn. n.**
  elongatum Uchida, 1928
  flaviscutellum Uchida, 1928
    tarsale Cushman, 1937 **syn. n.**
  perornatum (Cameron), 1902
  ocypeta **sp. n.**
  celeno **sp. n.**
  aello **sp. n.**
  scaposum (Morley), 1913*a*
    atrichiosoma Morley, 1913*a*
  flavitarse (Brullé), 1846
    trichiosomum Cameron, 1906
  perniciosum (Turner), 1919
  quodi (Vachal), 1907
  savaiiense (Fullaway), 1940
  townesi **sp. n.**

- ***datanae*** Riley, 1888
  - *flavicorne* Brullé, 1846
  - *fulvicorne* Townes, 1945 **syn. n.**
- ***nigricorne*** (Szépligeti), 1906 **comb. n.**
- ***amictum*** (Fabricius), 1775
  - *capitatum* Desvignes, 1856 **syn. n.**
  - *bucephalum* Brauns, 1898
  - *fulvicorne* Cameron, 1899 **syn. n.**
  - *tinctipenne* Cameron, 1899 **syn. n.**
  - *acheron* Morley, 1913*a* **syn. n.**
  - *acheron* var. *scutellatum* Morley, 1913*b* **syn. n.**
  - *sachalinensis* Matsumura, 1918
  - *crassicalx* Enderlein, 1921 **syn. n.**
  - *coreanum* Uchida, 1928 **syn. n.**
  - *amictum* var. *nigricoxalis* Uchida, 1928
  - *amictum* var. *intermedium* Uchida, 1928

Nomen inquirendum

- ***orbitale*** (Morley), 1913

The holotype and only known specimen of this species is deposited at the Museo Civico di Storia Naturale, Genoa. It has not been possible to examine this specimen. From the original description it would seem that this species is a synonym of *H. fulvitarse*.

MATERIALS EXAMINED AND METHODS USED

The following abbreviations have been used for depositories containing material which has been examined.

ANIC	Australian National Insect Collection, Canberra, Australia.
BMNH	British Museum (Natural History), London, England.
BPBM	Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A.
DEI	Deutsches Entomologisches Institut, Eberswalde, D.D.R.
EIHU	Entomological Institute, Hokkaido University, Sapporo, Japan.
HKT	Townes Collection, Ann Arbor, Michigan, U.S.A.
IRSNB	Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.
IZPAN	Instytut Zoologiczny, Warsaw, Poland.
MNMH	Muséum National d'Histoire Naturelle, Paris, France.
QM	Queensland Museum, Fortitude Valley, Qld., Australia.
RSM	Royal Scottish Museum, Edinburgh, Scotland.
TM	Természettudományi Múzeum, Budapest, Hungary.
UM	University Museum, Oxford, England.
USNM	Smithsonian Institution, National Museum of Natural History, Washington D.C., U.S.A.
WAM	Western Australian Museum, Perth, W.A., Australia.
ZI	Zoological Institute, Leningrad, U.S.S.R.

For each species discussed a standardized format has been adopted. Whenever possible descriptions are based on type-material examined. Notes on intraspecific variation are given in a separate paragraph. Recorded hosts and synopses of recorded distribution, together with the appropriate references, are listed in separate paragraphs.

Drawings were made using a Wild M5 binocular microscope with a camera lucida attachment, except for figures of the genitalia which were made using a Watson 'Bactil' microscope in conjunction with a squared eyepiece.

The method of male genitalia preparation is particularly important as excessive maceration with caustic potash (KOH) causes undue distortion of the aedeagal membranes. The method described by Gauld (1976) for genitalia preparation was adhered to in the present study.

A number of indices adopted in an earlier work have been used in the present study. These are:

CI (cubital index of forewing) =

$$\frac{\text{length of } Cu_1 \text{ between } 1m\text{–}cu \text{ and } Cu_{1a}}{\text{length of } Cu_{1b}}$$

ICI (intercubital index of forewing) =

$$\frac{\text{length of } 2 + 3rm}{\text{length of } M \text{ between } 2 + 3rm \text{ and } 2m\text{–}cu}$$

MI (marginal index of forewing) =

$$\frac{\text{length of } Rs}{\text{length of } Rs + 2r}$$

NI (nervellar index of hindwing) =

$$\frac{\text{length of } Cu_1 \text{ between } cu\text{–}a \text{ and } M}{\text{length of } cu\text{–}a}$$

The measurement of wing veins follows the method outlined by Gauld (1976).

The abbreviations IOD and OOD were used respectively for the inter-ocellar and orbito-ocellar distances. Measurements of lower face were made taking the height as the distance between the mid clypeal apex and a mid point on a level with the lower margins of the antennal sockets, and the width as the minimum distance between the internal orbits.

Morphological nomenclature in this work follows that of Richards (1956) as interpreted for the Anomaloninae by Gauld (1976). The naming of genitalia structures follows that proposed by Peck (1937). The naming of microsculpture follows the system proposed by Eady (1968) and the larval terminology follows that of Short (1959).

HETEROPELMA Wesmael

Heteropelma Wesmael, 1849 : 120. Type-species: *Heteropelma calcator* Wesmael, 1849 : 120, by monotypy.

Schizoloma Wesmael, 1849 : 120. Type-species: *Ichneumon amictus* Fabricius, 1775 : 341, by monotypy.

Schizopoma Foerster, 1868 : 145, 220. [Unjustified emendation.]

Tanypelma Townes, 1971 : 157. Type-species: *Heteropelma fulvicorne* Townes, 1945 : 129 [=*Heteropelma datanae* Riley, 1888 : 177], by original designation. **Syn. n.**

DESCRIPTION. Eyes without pubescence, inner margins from subparallel to convergent ventrally; occipital carina from close to posterior ocelli to widely separated from ocelli, rarely dorsally incomplete; frons with a weak to strong interantennal lamella. Antennae of moderate length, scape truncate, 1·3–1·7 times as long as pedicel; fourth flagellar segment 1·5–2·0 times as long as wide. Clypeus truncate, to rounded, sometimes with a pair of lateral swellings and apical clypeal margin reflexed; mandible bidentate, lower tooth always the shorter; labial palpi 4-segmented, cardo basally lobate. Genal carina reaching base of mandible.

Pronotum with a weak transverse furrow dorsally; posterior corner of pronotum partially occluding spiracular sclerite; lower anterior margin abruptly rounded without an apical concavity; notauli present, rarely absent. Mesopleuron dorsally usually rugose or coriaceous, lateroventrally punctate below a large speculum. Posterior transverse carina usually complete, rarely centrally absent.

Fore coxae smooth. Mid tibia usually bicalcarate, or in a Neotropical species with a single spur. Male hind tarsi swollen, 2nd segment usually with an impressed area ventrally which bears flattened microtrichia, or if rarely without this area then sometimes with microtrichia still present on ventral tarsal surface; hind claws usually geniculate and basally lobate, rarely simply curved.

Forewing with *Rs* weakly sinuate, $2 + 3rm$ proximal to $2m\text{–}cu$; $1m\text{–}cu$ and Cu_{1a} basally separate. Cu_1 between $cu\text{–}a$ and $1m\text{–}cu$, 0·80–1·05 times as long as $1m\text{–}cu$. Hindwing with 12–18 hamuli on vein R_1; distal abscissa of Cu_1 always present.

Propodeum reticulate, spiracle 2·50–3·50 times as long as broad; propodeum occasionally with conspicuous lateral protuberances. Gaster elongate, basal segments slender.

♀ genitalia. Valvula 3 a little longer than apical depth of gaster; apex of ovipositor strongly constricted, extreme apex decurved; conspicuous sclerotized nodus present (Text-fig. 55).

Ovarian egg obovate, dorsally flattened, bearing an obvious mushroom-like protuberance (the sucker of Iwata, 1958) that is basally extended anteriorly to form a thickened ridge or pair of ridges on the outer surface of the egg (Text-figs 56–64).

♂ genitalia. Single syntergum present; 9th abdominal sternite from almost quadrate to distinctly transverse; gonosquamae short, usually acute apically. Gonolacinia distally abruptly angled about 90°, teeth short to vestigial; basal apodeme angled at about 20° to the axis of the gonolacinia, reaching at least 0·65 of length of basivolsellar strut. Distivolsella slender, basally less than 0·5 times as broad as long, distally more or less swollen; teeth generally arranged diagonally on clasping face often with cluster on upper inner face, sometimes with smaller teeth distributed all over inner face. Aedeagal paramere proximally rounded, weakly spatulate or acute. Aedeagus in profile more or less sinuate, usually apically bilobate with obvious lateral sclerotized region; ventral membranous area bearing spines in specific patterns.

IMMATURE STAGES. Only the first instar larva of one species, *H. calcator*, has been described (Plotnikov, 1914). The characteristic features of this larva are the elongate caudal appendage and presence of a small mouth with minute mandibles. The second instar larva resembles the first but has a much shorter caudal appendage.

The final instar larvae of four species, *H. amictum*, *H. calcator*, *H. scaposum* and *H. datanae*, have been examined. The cephalic capsule of species of this genus is characterized by the broad pleurostoma and epistoma, short hypostoma and by having the labral sensilla arranged in two separate clusters. Most species were found to have the lateral ends of the hypostoma decurved, unlike species of *Therion* which have the hypostoma laterally straight. However, one species, *H. scaposum*, was observed to have the hypostoma laterally straight (Text-fig. 37). *H. amictum* and *H. datanae* were observed to have the ventral part of the labial sclerite lightly sclerotized. In the larva of *H. scaposum* this sclerite is medio-ventrally extremely weakly defined. *H. calcator* was observed to be more variable. Some specimens have been found with the labial sclerite medio-ventrally sclerotized whilst Short

(1970) observed that *H. calcator* has the ventral part of the labial sclerite incomplete and not sclerotized (Text-fig. 36).

Discussion of some characters. In previous work (Gauld, 1976) it was stated that *Heteropelma* species invariably have the inner margins of the orbits convergent ventrally and have the posterior transverse carina of the mesosternum complete. Exceptions have now been found to both these generalizations. A Papuan species, described below, was found to have the posterior transverse carina of the mesosternum centrally incomplete and *H. nigricorne* was observed to have the lower face subquadrate with the inner orbits extremely weakly convergent ventrally.

This recent advance in the state of knowledge of this group makes it desirable to modify couplet 7 in the key to genera included by Gauld (1976). The amended couplet should read:

7 (6) Posterior transverse carina of mesosternum interrupted before each mid coxa; propodeum simple without lateral protuberances; lower face at narrowest point at least 0·85 times as broad as high; hind tarsal claws simply curved; ♂ with proximal apodeme of gonolacinia angled at 40° to gonolaciniar axis and less than 0.3 times as long as basivolsellar strut. Holarctic, extending into the Neotropics as far as about 20°N and into the Oriental region as far as New Guinea . . . . ***THERION*** Curtis

– Posterior transverse carina of mesosternum complete, or if rarely incomplete then propodeum with conspicuous lateral protuberances; lower face less than 0·9 times as broad as high; hind tarsal claws often geniculate; ♂ with proximal apodeme of gonolacinia angled at about 20° to gonolaciniar axis and more than 0·6 times as long as basivolsellar strut. All regions except Ethiopian ***HETEROPELMA*** Wesmael

Couplet 8 is made redundant as, for reasons given below, *Tanypelma* has now been included as a synonym of *Heteropelma*.

In the work cited above, *Tanypelma* was included as a separate genus, but it was stated that this genus appeared to have close affinities with *Heteropelma*, and that its status might need reconsideration. Recently a number of additional species have been studied and as a result the status of *Tanypelma* has been re-examined.

The differences previously used for separating the two genera are tabulated below.

HETEROPELMA	*TANYPELMA*
Scutellum in profile flat (Text-fig. 24).	Scutellum in profile convex (Text-fig. 26).
NI less than 0·60.	NI greater than 0·80.
2nd hind tarsal segment of ♂ usually with an impressed area ventrally.	2nd hind tarsal segment of ♂ without an impressed area ventrally.
Lower face elongate.	Lower face subquadrate.

Most species of *Heteropelma* were observed to have the scutellum flattened and more or less longitudinally concave. Species referred to *Tanypelma* were observed to have the scutellum more or less strongly convex. However, two species, *H. quodi* and *H. savaiiense*, were found to have a weakly swollen scutellum intermediate between that of typical *Heteropelma* and *Tanypelma* (Text-fig. 25).

The differences in the range of variation of NI previously considered useful for effecting generic separation have been invalidated by the examination of additional material. A Brazilian species, *H. townesi*, resembles *Heteropelma* in most features (i.e. has the ♂ hind tarsi impressed, scutellum flat, etc.) but has NI between 0·70 and 0·90 thus overlapping the range of *Tanypelma*. *H. savaiiense* was observed to have NI equal to 0·70. The range of values of NI for *Heteropelma* must now be accepted to be 0·20–0·90 and it is therefore no longer possible to use this character to separate *Heteropelma* from *Tanypelma*.

The majority of species of *Heteropelma* have the 2nd hind tarsal segment of the male ventrally impressed. Two species of *Heteropelma* do not have such an impression present and thus resemble *Tanypelma*.

Tanypelma species have the lower face subquadrate whereas most species of *Heteropelma* have the lower face elongate. However, *H. nigricorne* has been found to have the lower face subquadrate.

Bearing in mind the combination of characters exhibited by *Tanypelma datanae* (the only species referable to the genus), it is apparent that this species differs somewhat from the majority of species of *Heteropelma*. Five other species differ as much, or more, from the majority of *Heteropelma* species as does *T. datanae* (Chart 2), but it would not be concomitant with the classificatory criteria adopted for the Therionini as a whole to accord each of these species separate generic status.

One may conclude that, because of the presence of intermediate species, and the existence of a much greater range of morphological variation than was presupposed to occur within the genus *Heteropelma*, the status of *Tanypelma* as a distinct genus can no longer be considered to be justifiable. It is suggested therefore that it should be included as a synonym of *Heteropelma* as formally stated above.

In earlier works (that is all pre-1970 literature) *Heteropelma* and *Schizoloma* were treated as distinct genera on account of differences in the form of the clypeus and ratio of hind basitarsus to 2nd tarsal segment. Numerous intermediate forms between the two extremes of clypeal shape have been found (this is discussed further under the variation occurring in *H. amictum*). There is a considerable range of variation in the values of the hind tarsal ratios between species. As the ranges of several species overlap, the apparent difference between *Heteropelma* and *Schizoloma* is invalidated. The author therefore concurs with the opinion of Townes (1971) who placed *Schizoloma* as a synonym of *Heteropelma*.

The characteristic form of the ovarian eggs of species of this genus was described by Iwata (1958). It has been possible to examine the ovarian eggs of six species, *H. fulvitarse*, *H. calcator*, *H. perornatum*, *H. amictum*, *H. celeno* and *H. scaposum* (Text-figs 56–64). The characteristic pedicel, called a sucker by Iwata, cannot in fact function as such, as the end is clearly distally convex (Text-fig. 56). The function of the pedicel is apparently to secure the egg to a suitable position within the host (Tothill, 1922). It is suggested that, rather than acting as a sucker, the membranous flange surrounding the distal apex of the pedicel functions as a barb preventing the pedicel from becoming dislodged from the tissue in which it had been embedded.

Specific differences were found in the form of the pedicel and its basal insertion. In the majority of species the pedicel was positioned postero-dorsally but in *H. scaposum* a particularly conspicuous pedicel was positioned medio-dorsally. The exact form of the anterior constricted region of the egg was observed to be variable. In immature eggs this region was extended into an elongate spout, whilst in more mature eggs the size of this spout was considerably reduced. The eggs of *H. scaposum* were not observed to have a spout.

SYSTEMATIC POSITION OF THE GENUS. *Heteropelma* is apparently related to *Habronyx* (*Habronyx*), *Therion* and less closely to *Trichomma*. All these genera share a number of features in common including specialized eggs, a slender distally swollen distivolsella and broad larval pleurostomae. The latter two genera have like *Heteropelma* the gonolacinial apodeme formed from a sclerotized portion of the outer margin of the gonolacinia. Gauld (1976) included a full discussion of the possible evolutionary significance of these and other characters but was unable to satisfactorily relate *Heteropelma* to *Therion* on account of marked differences in the form of the aedeagus. A Papuan species, *H. celeno*, was observed to have an aedeagus intermediate in structure between those of typical *Heteropelma* and *Therion*. A second and closely related Papuan species, *H. aello*, was observed to have an incomplete posterior transverse mesosternal carina, a characteristic of *Therion* rather than *Heteropelma*. However, in all other features these species were clearly referable to *Heteropelma*. It is now considered possible that *Heteropelma* may have evolved from a common ancestor with *Therion*, and that these two Papuan species represent the closest known species to this hypothetical ancestor.

KEY TO SPECIES OF *HETEROPELMA*

1 Propodeum with a pair of lateral thorn-like projections (Text-figs 33, 34); pronotum without a well developed hook on lower anterior margin (Text-fig. 29); gaster black, thorax predominantly brick red.
Papuan species 2

– Propodeum without thorn-like lateral projections; pronotum with moderately well developed hook on lower anterior margin (Text-figs 27, 28); gaster and thorax variously coloured, the latter usually darker than the former 3

2 Face with elongate black pubescence; lateral projection of propodeum very acute (Text-fig. 34); posterior transverse carina of mesosternum centrally absent
aello sp. n. (p. 176)

– Face with short pale pubescence; lateral projection of propodeum blunt (Text-fig. 33); posterior transverse carina of mesosternum complete . **celeno** sp. n. (p. 175)

3 Forewing with abscissa of *M* between 2 + 3*rm* and 2*m–cu* more than 3·0 times as long as 2 + 3*rm* (Text-fig. 39); an entirely brick red species.
Samoan Islands . . . . . . **savaiiense** (Fullaway) (p. 183)

– Forewing with abscissa of *M* between 2 + 3*rm* and 2*m–cu* less than 2·5 times as long as 2 + 3*rm* (Text-fig. 40); insect blackish marked on thorax or hind legs . . 4

4 Marginal cell elongate, *Rs* more than 2·0 times as long as *Rs* + 2*r* (Text-fig. 40); hind trochanter equal to or longer than trochantellus ventrally; Cu_1 between 1*m–cu* and Cu_{1a} less than 0·6 times as long as Cu_{1b}; mid tibia unicalcarate.
Neotropical species . . . . **townesi** sp. n. (p. 184)

– Marginal cell shorter, *Rs* less than 1·9 times as long as *Rs* + 2*r*; hind trochanter ventrally shorter than trochantellus; Cu_1 between 1*m–cu* and Cu_{1a} more than 0·6 times as long as Cu_{1b}; mid tarsi bicalcarate, rarely with inner spur very reduced . 5

5 Scutellum in profile swollen (Text-fig. 26); hind wing with NI greater than 0·70; male without either an impressed area or flattened microtrichia on 2nd hind tarsal segment.
Nearctic species . . . . ***datanae*** Riley (p. 185)

– Scutellum in profile flat (Text-figs 24, 25); hind wing usually with NI less than 0·65; male with either an impressed area or flattened microtrichia or both on ventral surface of 2nd hind tarsal segment 6

6 Hind basitarsus bicoloured, proximally black, distally yellowish; Australasian species 7

– Hind basitarsus unicolorous yellow, very rarely with indistinct infuscation at extreme proximal end; Palaearctic or Oriental species 10

7 Hind legs except tarsi almost entirely black; wings strongly infumate; tegulae black; New Caledonia . . . . ***quodi*** (Vachal) (p. 182)

– Hind legs with at least femora broadly red marked; wings hyaline or very weakly infumate; tegulae often yellow; Australian species 8

8 Hind tarsal claws weakly curved, without a basal lamella (Text-fig. 31); lower face usually black marked, always with elongate black pubescence; hind coxa ventrally with dense elongate pubescence; hind ocelli separated from occipital carina by a distance about equal to an ocellar diameter and flagellum with 60+ segments.
Large species, forewing length 12–16 mm; Tasmania and southern Australia ***flavitarse*** (Brullé) (p. 180)

– Hind tarsal claws geniculate with a strong basal lobe or lamella (Text-fig. 30); lower face usually entirely yellowish with pallid pubescence; hind coxa ventrally with short sparse pubescence; hind ocelli separated from occipital carina by a distance greater than 1·2 times the ocellar diameter or flagellum with less than 58 segments or both 9

9 Thorax mainly black; dorsum of tergite 3 0·90 times or more as long as tergite 4; common species . . . . ***scaposum*** (Morley) (p. 177)

– Thorax almost entirely reddish brown, only black marked dorsally and ventrally; dorsum of tergite 3 0·80 times or less as long as tergite 4; rare species ***perniciosum*** (Turner) (p. 181)

10 Hind basitarsus more than 3·00 times as long as 2nd tarsal segment; clypeus evenly rounded, in profile not swollen 11

– Hind basitarsus less than 2·80 times as long as 2nd tarsal segment; clypeus with a weakly to very strongly produced pair of lateral swellings, in profile convex or apically reflexed (Text-figs 16–18) 16

11 Mid tibia with spurs extremely inequal, the inner spur vestigial, less than 0·25 times as long as the outer (Text-fig. 35); occipital carina separated from posterior ocelli by more than 1·30 times ocellar diameter (Text-fig. 10).
Thorax highly polished; Malaysian species . . . ***ocypeta*** sp. n. (p. 174)

– Mid tibia with subequal to inequal spurs, the inner spur at the very least 0·45 times as long as the outer; occipital carina separated from posterior ocelli by less than 1·20 times ocellar diameter (Text-figs 1–6) 12

12 Mid tibial spurs inequal, the longer about 2·0 times as long as the shorter and the interantennal lamella vestigial (Text-fig. 23); scutellum yellow; flagellum with about 45 segments; male with hind basitarsus and 2nd tarsal segment confluent in outline, the latter without an impressed ventral area (Text-fig. 38)
Japan, Taiwan. . . . . ***flaviscutellum*** Uchida (p. 170)

– Mid tibial spurs generally subequal, the longer less than 1·5 times as long as the shorter or if very rarely with the longer 1·6–1·8 times as long as the shorter then the interantennal lamella is strongly developed (Text-fig. 20); interantennal lamella moderately to strongly developed (Text-figs 20–22); scutellum usually black; flagellum often with more than 46 segments; male with 2nd hind tarsal segment in outline discrete from basitarsus, and often with a ventral impressed area on the former (Text-fig. 41) 13

13 Head posteriorly very strongly narrowed (Text-fig. 6); occipital carina medio-dorsally flattened with a more or less distinct median dip; flagellum with about 55 segments; pronotum with postero-dorsal half smooth with scattered punctures (Text-fig. 27).
Borneo . . . . **perornatum** (Cameron) (p. 173)

– Head less strongly narrowed (Text-figs 1–5); occipital carina medio-dorsally usually convex, rarely slightly flattened but then with flagellum with 60+ segments; pronotum with postero-dorsal half coriaceous 14

14 Head when viewed dorsally with genae broad and weakly constricted (Text-figs 3, 4); flagellum with 48 or less segments; hind coxa usually entirely black, rarely in some east European specimens with reddish marks.
Palaearctic; coniferous woodlands . . . **calcator** Wesmael (p. 164)

– Head when viewed dorsally with genae not exactly as above, somewhat more posteriorly constricted (Text-figs 1, 2, 5); flagellum with 50+ segments; hind coxa entirely red or with extreme proximal margin black. 15

15 Hind basitarsus more than 4·8 times as long as 2nd tarsus; male without an impressed area on 2nd hind tarsal segment; propodeum dorsally about as long as broad; interantennal lamella triangular in profile (Text-fig. 22); flagellum with 60+ segments; eastern Palaearctic . . . . **elongatum** Uchida (p. 169)

– Hind basitarsus less than 4·50 times (usually less than 4·30 times) as long as 2nd tarsus; male with an impressed area on 2nd hind tarsal segment; propodeum dorsally broader than long; interantennal lamella trapezoidal in profile (Text-fig. 20); Oriental and Palaearctic . . . . **fulvitarse** Cameron (p. 167)

16 Lower face subquadrate, about 0·80 times as broad as high (Text-fig. 14); IOD 0·6 times as long as OOD; vertex immaculately black; flagellum blackish; clypeus with weak lateral protruberances.
S. India . . . . **nigricorne** (Szépligeti) (p. 187)

– Lower face elongate, less than 0·70 times as broad as high (Text-fig. 16); IOD 0·65 or more times as long as OOD; vertex with yellow marks . **amictum** (Fabricius) (p. 188)

DESCRIPTIONS OF SPECIES

Heteropelma calcator Wesmael

(Text-figs 3, 4, 19, 36, 48, 59, 63)

Heteropelma calcator Wesmael, 1849 : 120. Syntypes, BELGIUM (IRSNB) [not examined].
Heteropelma calcator Wesmael; Morley, 1913*a* : 69.
Heteropelma calcator Wesmael; Plotnikov, 1914 : 34.
Heteropelma calcator Wesmael; Morley, 1915 : 231.
Heteropelma calcator Wesmael; Uchida, 1928 : 237.
Heteropelma calcator Wesmael; Meyer, 1935 : 60.
Heteropelma calcator Wesmael; Schmiedeknecht, 1935 : 62.
Heteropelma calcator Wesmael; Uchida, 1958 : 94.
Heteropelma calcator Wesmael; Iwata, 1958 : 70.
Heteropelma calcator Wesmael; Townes, Momoi & Townes, 1965 : 382.
Heteropelma calcator Wesmael; Constantineanu & Petçu, 1969 : 93.
Heteropelma calcator Wesmael; Gauld, 1973 : 304.

The type-material of this species was being studied by Dr Schnee (August, 1975) who was preparing a work on European Anomaloninae.

DESCRIPTION. Lower face 0·60–0·70 times as broad as high; clypeus apically simply convex, in profile almost flat; mandibles twisted about 15°, the upper tooth about 2·00 times as long as lower; IOD 1·10–1·40 times as long as OOD; posterior ocelli separated from occipital carina by about maximum ocellar diameter. Head rather weakly constricted posteriorly, vertex punctate to coriaceous; occipital carina medio-dorsally usually evenly rounded, sometimes flattened. Flagellum of moderate length, 43- to 48-segmented; 1st flagellar segment 2·0–2·3 times as long as 2nd; interantennal lamella strong, in profile almost square. Face with long, yellowish brown pubescence.

Pronotum coriaceous, anterior hook strong. Mesoscutum coriaceous, laterally punctate; notauli strong, reaching beyond centre of mesoscutum; mesoscutal pubescence long, yellowish brown in colour. Mesopleuron dorsally rugose, lateroventrally punctate; epicnemial carina reaching above centre of mesopleuron, bowed so that upper end reaches anterior pleural margin; sternaulus weak. Scutellum usually longitudinally concave, slightly elongate, coriaceous. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral projections, ventrally sculptured; propodeum dorsally 0·70–0·80 times as long as broad.

Mid tibial spurs subequal, the outer about 1·10 times as long as inner. Hind leg with basitarsus 0·50–0·60 times as long as tibia, 3·40–3·80 times as long as 2nd tarsal segment; 2nd tarsal segment 1·90–2·20 times as long as 3rd; trochanter 0·80–0·90 times as long as trochantellus ventrally; hind tarsal claw geniculate, basally strongly lobate. ♂ with 2nd hind tarsal segment with an impressed ventral area.

Wings very weakly infumate; CI = 0·55–0·80; MI = 1·75–1·90; ICI = 0·90–1·40; NI = 0·45–0·50. Forewing length 8–11 mm.

Gaster with tergite 2 2·20–2·40 times as long as tergite 3; ♀ with ovipositor about 0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in apical cluster and with a short row of double spines on ventral region. Aedeagus in profile apically subequally bilobate; lateral sclerotized region apically dilated, indistinctly delineated.

Head black, lower face and orbital marks yellow; flagellum reddish, proximally black. Thorax black, tegulae reddish. Legs reddish brown, coxae usually black, rarely reddish tinged or occasionally entirely red distally; distal 0·3 of hind tibia black, hind tarsi yellow. Gaster reddish, black marked on dorsal margin of tergite 2 and with terminal segments infuscate.

VARIATION. This species exhibits less variation than the related species *H. fulvitarse* although it extends over a large range. Specimens from eastern Europe occasionally have the hind coxae distally red but all such specimens were observed to have the coxae black at extreme proximal ends.

REMARKS. This is one of the commonest Palaearctic species of Anomaloninae, about which a very considerable body of literature has accumulated. An excellent account of the biology and descriptions of the larval stages were included by Plotnikov (1914). The ovarian egg was described by Iwata (1958). This species is a well known parasite of *Bupalus piniaria* (L.) and because this moth is an important pest of conifer plantations a number of workers have studied the host-parasite interrelationship (Ljungdahl, 1916; Ritzema, 1920; Seitner, 1922; Sitowski, 1922; Barbey, 1927; Gornitz, 1931; Steiner, 1931; Friedrichs, Schaerffenberg & Sturm, 1941; Hedqvist, 1949 and Malysheva, 1960; 1962).

The following brief account of adult behaviour is based on personal observation of two populations, one at Cannock Chase, Staffordshire, England and a second at Craigen Darroch, Grampian, Scotland.

H. calcator is generally associated with *Pinus* woodlands. It seems to prefer areas in which there are many young trees (2–3 m high) or in which taller trees (4–5 m) are widely spaced. Males appear in mid July and specimens of both sexes are most common in mid August.

In flight both sexes adopt a very characteristic attitude, flying with antennae outstretched, hind legs fully extended at about 30° to the axis of the body and with the slender gaster elevated at about 15°. A considerable amount of the flight path is in the vertical plane, close to the conifer foliage.

At night and during periods of inclement weather both sexes rest on conifer twigs. At rest they elevate the gaster at an angle approximately the same as that subtended by the leaves to the twigs. Thus the insect renders itself very inconspicuous.

Males adopt a characteristically rapid flight in clearings, rising vertically and sinking, with the conspicuous hind tarsi outstretched. Two or three males behaving so together have been seen, but no evidence for aggregate male displays exists. Whether this behaviour is some form of pre-copulatory sexual display is not known.

The female searches for prospective hosts on the wing, and alights only for the briefest moments to preen the antennae and wings. Having located a suitable host (usually the early instar larvae of *B. piniaria*) the female alights, reflexes the ovipositor forward and then oviposits, after which she resumes flight. The reflexing of the ovipositor serves to move an egg from the ovipositor base to an expanded chamber immediately proximal to the nodus. During this reflexing the 1st valvulae are retracted relative to the 2nd valvulae, and the valvilli (a pair of minute flanges of tissue positioned on the distal internal faces of the 1st valvulae, vide Gauld, 1976) engage the egg. As the 1st valvulae slide along the 2nd to regain their resting position the egg is forced down the lacuna of the ovipositor by the valvilli. Thus when the ovipositor is inserted into the lepidopterous larva an egg is already positioned near the apex.

Observation of acts of oviposition were too infrequent to permit any reliable inferences being made about the position of insertion of the ovipositor into the host.

H. calcator is undoubtedly closely related to the Oriental species *H. fulvitarse* which apparently occupies a similar ecological niche in the Oriental region. The two species are morphologically rather similar but it seems possible to separate the two by differences in head shape (Text-figs 1–4) and usually by differences in coxal coloration. Whether or not these differences will prove to be reliable when the fauna of western and central Asia is better known is a matter of great interest.

HOST RECORDS. Other than *B. piniaria* which is referred to above, this species has been recorded as a parasite of *Panolis flammea* (Denis & Schiffermüller) (Meyer, 1935; Schmiedeknecht, 1935), *Anarta myrtilli* (L.) (Schmiedeknecht, 1935), *Bena prasinana* (L.) (Morley, 1915; Meyer, 1935).

DISTRIBUTION (Map 1). This species has been recorded from most European countries (Schmiedeknecht, 1935), but is perhaps absent in the south as Ceballos (1963) failed to find it in Spain. Meyer (1935) recorded this species from many localities in the U.S.S.R. Uchida (1958) recorded this species from eastern U.S.S.R., China, Korea and Japan.

MATERIAL EXAMINED.

BELGIUM: 1 ♀, no further data (BMNH). GERMANY: 4♀, 2♂, no further data (BMNH). GREAT BRITAIN: 11 ♀, 14♂, Devon, Lustleigh, vii. 1934 (*R. C. L. Perkins*) (BMNH); 10 ♀, 10 ♂, Grampian 'Aberdeenshire', Ballater, Craigen Darroch, vii. 1975 (*Gauld*) (BMNH); 5 ♀, 7 ♂, Hampshire, New Forest, vii–viii. 1927–1936 (*Morley*) (BMNH); 40 ♀, 48 ♂, Staffordshire, Cannock Chase, bred ex *B. piniaria* on *Pinus sylvestris* L., vi. 1954 (*Forestry Commission*) (BMNH); 10 ♀, 10 ♂, same locality, on *Pinus* sp., viii. 1972–1973 (*Gauld*) (BMNH). NORWAY: 3 ♀, 3 ♂, Brekkesto, viii. 1938 (*Chaworth-Musters*) (BMNH). RUMANIA: 2 ♀, 1 ♂, no further data. SWEDEN: 1 ♀, Fjellfota sjö, vii. 1938 (*J. F. Perkins*) (BMNH). TURKEY: 1 ♀, Unye, vii. 1972, no further data (BMNH).

Heteropelma fulvitarse Cameron

(Text-figs 1, 2, 20, 28, 41, 52, 55, 62)

Heteropelma fulvitarse Cameron, 1899 : 111. Holotype ♀, INDIA (UM) [examined].
Heteropelma reticulatum Cameron, 1899 : 110. Holotype ♂, INDIA (UM) [examined]. **Syn. n.**
Anomalon binghami Cameron, 1907 : 14. Holotype ♂, INDIA: Sikkim (BMNH) [examined]. **Syn. n.**
Heteropelma fulvitarse Cameron; Morley, 1913*a* : 70.
[*Exochilum acheron* Morley, 1913*a* : 79. Partim, 1 ♂ from Shanghai. Misidentification.]
Anomalon binghami Cameron; Morley, 1913*a* : 84.
[*Heteropelma calcator* Wesmael; Morley, 1913*b* : 406. Misidentification.]
Heteropelma fulvitarsis Cameron; Morley, 1913*b* : 407.
Anomalon binghami Cameron; Morley, 1913*b* : 424.
Anomalon? *binghami* Cameron; Morley, 1914 : 325.
Heteropelma grossator Shestakov, 1923 : 46. Holotype ♀, U.S.S.R. (ZI) [examined]. **Syn. n.**
[*Heteropelma calcator* Wesmael; Dutt, 1923 : 18. Misidentification.]
Heteropelma grossator Shestakov; Meyer, 1935 : 60.
Heteropelma perlongum Cushman, 1937 : 297. Holotype ♀, TAIWAN (DEI) [examined]. **Syn. n.**
Heteropelma panargis Heinrich, 1953 : 181. Holotype ♂, GERMANY (WEST) (HKT) [examined]. **Syn. n.**
Heteropelma perlongum Cushman; Uchida, 1958 : 94.
Heteropelma binghami (Cameron) Townes *et al.*, 1961 : 321.
Heteropelma fulvitarse Cameron; Townes *et al.*, 1961 : 321.
Heteropelma perlongum Cushman; Townes *et al.*, 1961 : 321.
Heteropelma reticulatum Cameron; Townes *et al.*, 1961 : 322.
Heteropelma grossator Shestakov; Townes *et al.*, 1965 : 383.

DESCRIPTION. Lower face 0·60–0·70 times as broad as high; clypeus apically simply convex, in profile rather flat; mandibles twisted about 20°, the upper tooth 2·0–3·0 times as long as lower. IOD 0·90–1·30 times as long as OOD; posterior ocellus separated from occipital carina by less than the greatest ocellar diameter. Head constricted posteriorly, vertex closely punctate to coriaceous; occipital carina evenly rounded or rarely medio-dorsally concave. Flagellum of moderate length, 50- to 55-segmented; 1st flagellar segment 2·10–2·50 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with long pale pubescence.

Pronotum coriaceous, anterior hook strong. Mesoscutum rather coarsely punctate, centrally rugose; notauli moderately strongly to weakly impressed, discernible to centre of scutum; mesoscutal pubescence short, usually ruddy or badious, rarely yellowish red. Mesopleuron dorsally rugose or reticulate, latero-ventrally finely punctate; epicnemial carina usually reaching to centre of mesopleuron, bowed and with upper end reaching anterior pleural margin; sternaulus weak. Scutellum longitudinally concave or flat, elongate, rugosely punctate. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral protuberances, ventrally strongly sculptured; propodeum dorsally 0·80–0·95 times as long as broad.

Mid tibial spurs subequal, the outer about 1·1 times as long as inner. Hind leg with basitarsus 0·55–0·65 times as long as tibia, 3·60–4·20 times as long as 2nd tarsal segment; 2nd tarsal segment 1·70–2·60 times as long as 3rd segment; trochanter 0·75–0·95 times as long as trochantellus ventrally; hind tarsal claw geniculate, basally with a strong lamella. 2nd hind tarsal segment of ♂ ventrally impressed.

Wings weakly infumate; CI = 0·55–0·85; MI = 1·60–1·90; ICI = 0·70–1·30; NI = 0·40–0·50. Forewing length 10–15 mm.

Gaster with tergite 2 2·00–2·20 times as long as tergite 3; ♀ with ovipositor 0·50–0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in an apical cluster and with short spines in a double row on ventral margin of distivolsella. Aedeagus in profile apically obliquely truncate; lateral sclerotized area apically acute, ventrally extended (Text-fig. 52).

Head black, face and genal marks yellow; antennae reddish or yellowish distally. Thorax black, tegulae reddish yellow. Anterior two pairs of legs yellowish, hind legs reddish, tibia distally darker, tarsi paler; gaster reddish.

VARIATION. This species was observed to be morphologically rather variable. There was observed to be a marked clinal variation in the specimens examined, those from the west of the range being generally darker and stouter than those from the east. Intermediates between the extremes of variation have been observed. To some extent the island populations, particularly that of Taiwan, are separable from the mainland form. The Taiwanese specimens were found to have the flagella pale yellowish and the scape not at all black marked as is most usual in this species. There are, however, no consistent morphological differences between the island and the mainland Chinese populations. As already mentioned there is a tendency for the specimens in the east of the range to be paler and so it is considered that the Taiwan population is conspecific with the mainland population.

A single ♀ from Hainan differs from the mainland Chinese population in having the lower tooth of the mandible subequal to the upper. There is quite a considerable variation of the ratio of lengths of the mandibular teeth within any one population and although no other specimens have been found with such subequal teeth it was considered possible that the Hainan specimen may represent an extreme variant of *H. fulvitarse*.

The holotypes of *H. grossator* Shestakov and *H. panargis* Heinrich were observed to have the head posteriorly strongly constricted and have a centrally depressed occipital carina. In all other features these species are similar to typical *H. fulvitarse* specimens and as head shape and the form of the occipital carina are very variable features *H. grossator* and *H. panargis* are included as synonyms of *H. fulvitarse*.

Isolated specimens of *H. fulvitarse* were observed to have the mid tibial spurs rather inequal, the longer about 1·50 times the length of the shorter. These specimens differ from *H. flaviscutellum* in having the interantennal lamella strongly developed, the 2nd hind tarsal segment of the ♂ with an impressed ventral area and having a black scutellum.

REMARKS. This species apparently replaces *H. calcator* in the Oriental region. No biological information is at present available.

HOST RECORDS. None available.

DISTRIBUTION (Map 1). This species has been recorded from northern India and Sikkim (Cameron, 1899; 1907; Morley, 1913*b*). The latter author also recorded this species from Burma. It has been recorded from U.S.S.R. (Shestakov, 1923; Meyer, 1935) and Taiwan (Cushman, 1937; Uchida, 1958).

MATERIAL EXAMINED.

Heteropelma fulvitarse Cameron, holotype ♀, INDIA: Assam, Khasia Hills (UM). *Heteropelma reticulatum* Cameron, holotype ♂, INDIA: Assam, Khasia Hills (UM). *Anomalon binghami* Cameron, holotype ♂, INDIA: Sikkim (BMNH). *Heteropelma grossator* Shestakov, holotype ♀, U.S.S.R.: Tomsk, Yelizavetinskiy (ZI). *Heteropelma perlongum* Cushman, holotype ♀, TAIWAN (DEI). *Heteropelma panargis* Heinrich, holotype ♂, GERMANY (WEST): Steiermark (HKT); paratype, 1 ♂, same data as holotype (HKT).

BURMA: 1 ♂, Maymayo, xii. 1937 (*Heinrich*) (HKT); 3 ♀, 5 ♂, Mt Victoria, iv. 1938 (*Heinrich*) (HKT). CHINA: 6 ♀, Fukien, Shaowu Hsien, iv–v. 1942–1945 (*Maa*) (HKT); 1 ♀, Tibet, Yatung, vii. 1924 (*Hingston*) (BMNH); 1 ♀, no further data (BMNH). INDIA: 2 ♀, Simla, vii. 1918 (*Brunetti*) (BMNH); 1 ♀, Assam, Mishmi Hills, xi. 1936 (BMNH); 2 ♂, no further data (BMNH); 3 ♀, 4 ♂, no further data (UM). LAOS: 1 ♀, Muong Pek, xii. 1918 (*Salvaza*) (BMNH). NEPAL: 1 ♀, 1 ♂, Taplejung, x–xi. 1961 (*Coe*) (BMNH). TAIWAN: 1 ♀, Taiheizan, vii. 1934 (*Gressitt*) (HKT); 1 ♀, Musha, v. 1932 (*Gressitt*) (HKT); 1 ♂, Arizan, viii. 1908 (*Wileman*) (BMNH).

Heteropelma elongatum Uchida

(Text-figs 5, 22, 50)

Heteropelma calcator var. *elongatum* Uchida, 1928 : 238. Lectotype ♂, JAPAN (EIHU), designated by Townes *et al*., 1965 : 383 [examined].
Heteropelma elongatum Uchida; Uchida, 1953 : 127.
Heteropelma elongatum Uchida; Uchida, 1958 : 94.
Heteropelma elongatum Uchida; Iwata, 1960 : 168.
Heteropelma elongatum Uchida; Townes *et al*., 1965 : 383.

DESCRIPTION. Lower face 0·60–0·65 times as broad as high; clypeus apically simply convex, in profile rather flat; mandibles twisted about 15°, the upper tooth about 2·00 times as long as the lower. IOD 0·90–1·10 times as long as OOD; posterior ocellus separated from occipital carina by less than maximum ocellar diameter. Head constricted posteriorly, vertex coriaceous, laterally grading to coarsely punctate; occipital carina evenly rounded. Flagellum elongate, 61- to 65-segmented; 1st flagellar segment 2·20–2·30 times as long as 2nd; interantennal lamella of moderate size, in profile more or less triangular. Face with long pale pubescence.

Pronotum coriaceous, anterior hook strong. Mesoscutum centrally coriaceous, laterally punctate; notauli moderately strong, reaching beyond centre of scutum; mesoscutal pubescence short, yellowish red. Mesopleuron dorsally reticulate, latero-ventrally punctate; epicnemial carina strong, reaching to about centre of mesopleuron, usually with upper end remote from anterior pleural margin; sternaulus indistinct. Scutellum longitudinally concave. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral protuberences, ventrally strongly sculptured; propodeum dorsally about 1·00 times as long as broad.

Mid tibial spurs subequal, the outer about 1·20 times as long as inner. Hind leg with basitarsus 0·66–0·68 times as long as tibia, 4·90–5·90 times as long as 2nd tarsal segment; 2nd tarsal segment 1·70–1·80 times as long as 3rd tarsal segment; trochanter 0·83–0·88 times as long as trochantellus ventrally; hind tarsal claw geniculate with a strong basal lamella. ♂ without an impressed area on 2nd hind tarsal segment.

Wings weakly infumate; CI = 0·53–0·68; MI = 1·50–1·80; ICI = 0·60–1·20; NI = 0·50–0·65. Forewing length 12–17 mm.

Gaster with tergite 2 2·10–2·20 times as long as tergite 3; ♀ with ovipositor 0·45 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in apical cluster and with short row of double spines extending down ventral margin. Aedeagus in profile apically subequally bilobate; lateral sclerotized area apically broadened, indistinctly delineated.

Head black, lower face marks on genae yellow; antennae reddish. Thorax black, tegulae reddish yellow. Anterior two pairs of legs yellowish, hind legs reddish, tibia distally darker, trochanter ventrally pale. Gaster reddish.

VARIATION. Some variation in the coloration was observed. The female from China was found to have the hind coxa somewhat more swollen than is typical for this species. Slight variation in the shape of the interantennal lamella was also observed, a few specimens tending to have the lamella subquadrate in profile.

REMARKS. This species is clearly very closely related to *H. fulvitarse* from which it differs in having a longer flagellum (61–65 segments compared with 50–55), the hind basitarsus extremely elongate (4·90–5·90 times as long as tarsus 2 compared with 3·60–4·20 times as long as tarsus 2) and having the 2nd hind tarsal segment of the ♂ devoid of an impressed area.

HOST RECORDS. None available.

DISTRIBUTION (Map 1). This species has previously been recorded from Japan (Uchida, 1928; 1958).

MATERIAL EXAMINED.

Heteropelma elongatum Uchida, lectotype ♂, JAPAN: Honshu, Tokyo, v. 1918 (*Teranischi*) (EIHU).

JAPAN: 1 ♂ (*Teranischi*) (HKT). CHINA: 1 ♀, Fukien, Shaowu Hsien, ix. 1943 (*Maa*) (HKT); 2 ♂, same locality, v. 1943 (*Maa*) (HKT); 1 ♂, Tsin Leong San, vi. 1936 (*Kwantung*) (HKT).

Heteropelma flaviscutellum Uchida

(Text-figs 23, 38)

Heteropelma calcator var. *flaviscutellum* Uchida, 1928: 238. Lectotype ♂, JAPAN (EIHU), designated by Townes *et al.*, 1965 : 383 [examined].

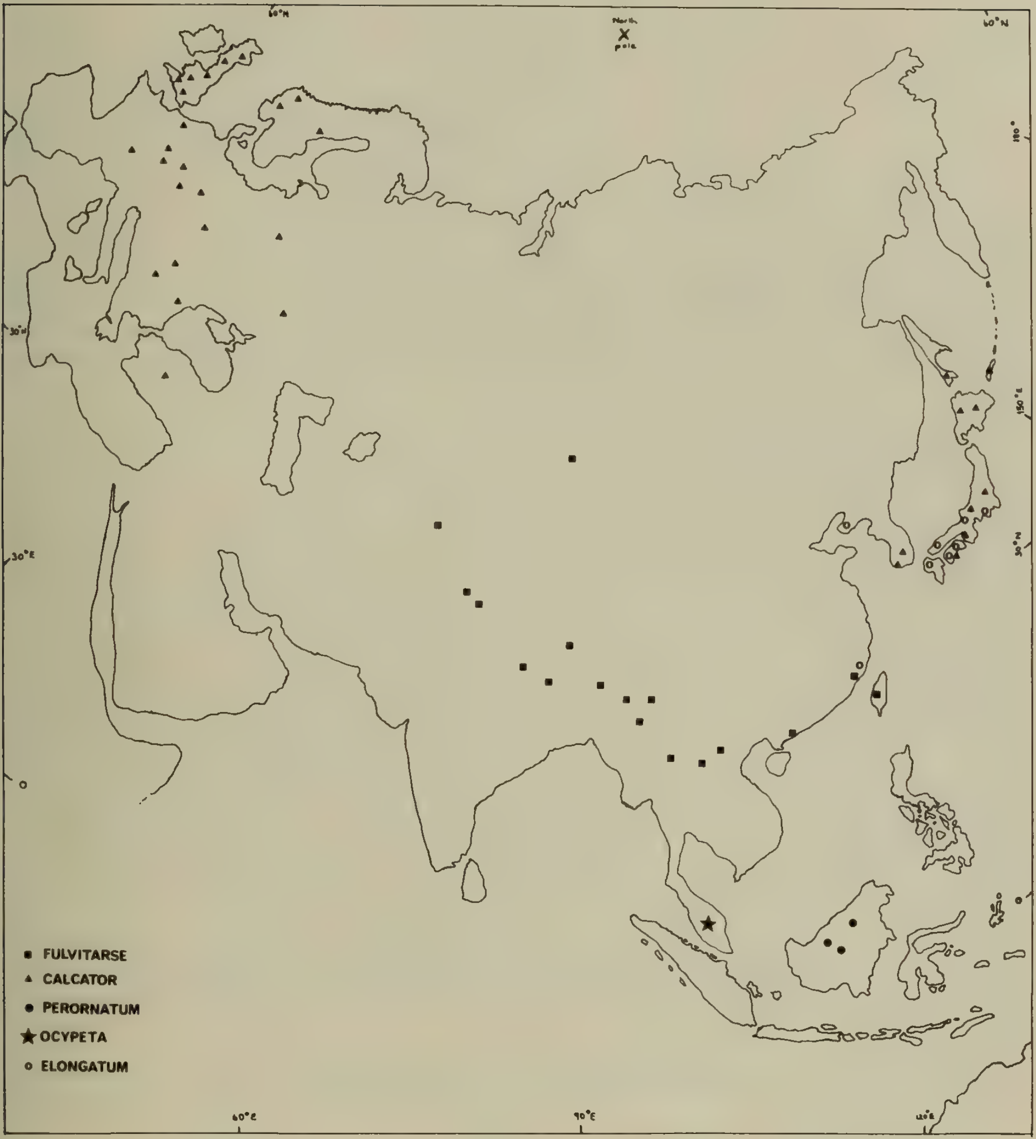
Heteropelma tarsale Cushman, 1937 : 298. Holotype ♀, TAIWAN (DEI) [examined]. **Syn. n.**

Heteropelma flaviscutellum Uchida; Uchida, 1958 : 95.

Heteropelma tarsale Cushman; Uchida, 1958 : 95.

Heteropelma tarsale Cushman; Townes *et al.*, 1961 : 322.

Heteropelma flaviscutellum Uchida; Townes *et al.*, 1965 : 383.


60°N
North pole
60°N
180°
150°E
30°N
30°N
30°E
60°E
90°E
120°E
■ FULVITARSE
▲ CALCATOR
● PERORNATUM
★ OCYPETA
○ ELONGATUM

MAP 1. Palaearctic and Oriental zoogeographic regions (Zenithal equal projection; origin 40°N, 95°E) showing distributions of *Heteropelma fulvitarse*, *H. calcator*, *H. perornatum*, *H. ocypeta* and *H. elongatum*.

Description. Lower face 0·65–0·75 times as broad as high; clypeus apically simply convex, in profile swollen; mandibles twisted about 5°, upper tooth slightly less than 2·00 times as long as lower. IOD equal to OOD; posterior ocellus separated from occipital carina by about 0·90 times maximum ocellar diameter. Head posteriorly moderately constricted, vertex punctate; occipital carina medio-dorsally evenly rounded. Flagellum rather long and slender, 45-segmented, 1st flagellar segment about 1·80 times as long as 2nd; interantennal lamella almost absent. Face with long pallid pubescence.

Pronotum coriaceous, anterior hook moderately developed. Mesoscutum coarsely punctate; notauli strong, reaching beyond centre of scutum; mesoscutal pubescence short and pale. Mesopleuron dorsally coriaceous, ventrally sparsely punctate; epicnemial carina reaching above centre of pleuron, bowed so that upper end reaches anterior margin of mesopleuron, sternaulus weak. Scutellum convex, quadrate, striate. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral protuberance, ventrally strongly sculptured; propodeum dorsally 0·80 times as long as broad.

Mid tibial spurs inequal, the outer about 2·00 times as long as the inner. Hind leg with basitarsus 0·62–0·65 times as long as tibia, 4·30–6·10 times as long as 2nd tarsal segment; 2nd tarsal segment 1·30–1·90 times as long as 3rd tarsal segment; trochanter 0·73–0·77 times as long as trochantellus; hind tarsal claws as *fulvitarse*. Hind tarsus of ♂ without an impressed area.

Wings very weakly infumate; CI = 0·72–0·87; MI = 1·73–1·81; ICI = 1·44–1·60; NI = 0·63–0·70. Forewing length 10–11 mm.

Gaster with tergite 2 about 1·80 times as long as tergite 3; ♀ with ovipositor 0·50 times as long as tergite 2.

♂ genitalia. Not available for dissection.

Head black, lower face and vertical marks yellow; antennae reddish yellow. Thorax black, tegulae reddish, scutellum yellow. Anterior two pairs of legs yellow, hind legs brownish, coxae proximally darker, tibia distally dark brown, tarsi pale yellow.

Variation. The colour of this species is extremely variable. In some females the thorax was observed to be almost entirely badious with more reddish areas at bases of notauli, on mesopleuron and margins of the various sclerites. The scutellum, tegulae and sometimes subalar prominences were observed to be yellow. In the lighter specimens the antennae are yellowish, gaster except for the dorsum of tergite 2 orange-red, hind legs except for tarsi, distal 0·30 of tibia and dorsum of trochanter yellowish brown. Intermediates between this extreme and the typical form have been seen.

Remarks. The basitarsus and 2nd tarsal segment of males of this species are unusual in being particularly intimately associated and in outline continuous with each other. This feature enables males to be distinguished from all other species.

Host records. None available.

Distribution. Previously recorded from Japan and Taiwan (Uchida, 1928; 1958; Cushman, 1937).

Material examined.

Heteropelma flaviscutellum Uchida, lectotype ♂, Japan: Hokkaido, Jozankeim, viii. 1924 (*Uchida*) (EIHU). *Heteropelma tarsale* Cushman, holotype ♀, Taiwan: Kankau, Koshun, v. 1912 (*Sauter*) (DEI); paratypes, 1 ♀, same data as holotype, 1 ♂ same locality and collector as holotype, viii. 1908 (DEI).

Taiwan: 1 ♀, Kuraru, v. 1934 (*Gressitt*) (HKT).

Heteropelma perornatum (Cameron)

(Text-figs 6, 21, 24, 27, 44, 58)

Anomalon perornatum Cameron, 1902 : 50. LECTOTYPE ♀, BORNEO: Sarawak (BMNH), here designated [examined].
Anomalon perornatum Cameron; Szépligeti, 1905 : 12.
Heteropelma perornatum (Cameron); Morley, 1913*a* : 70.
Heteropelma perornatum (Cameron); Townes *et al.*, 1961 : 321.

DESCRIPTION. Lower face 0·60–0·65 times as broad as high; clypeus apically simply convex, in profile weakly swollen; mandibles twisted about 35°, the upper tooth twice as long as the lower. IOD 1·10–1·40 times as long as OOD; posterior ocelli separated from occipital carina by about 0·90 times a maximum ocellar diameter. Head strongly constricted, vertex smooth with scattered punctures; occipital carina medio-dorsally usually dipped, rarely simply flattened. Flagellum of moderate length 53- to 55-segmented; 1st flagellar segment 1·90–2·10 times as long as 2nd; interantennal lamella weak, in profile obtusely triangular. Face with short pale pubescence.

Pronotum dorsally rather polished, smooth with obsolescent scattered punctures, ventrally strongly rugose, anterior hook strong. Mesoscutum punctate or rugulose; notauli weakly impressed but nevertheless obvious, extending beyond the centre of the scutum; mesoscutal pubescence short and pale. Mesopleuron dorsally strongly rugose, ventrally smooth with obsolescent punctures; epicnemial carina strong, reaching above centre of mesopleuron, bowed so that upper end reaches anterior pleural margin; sternaulus weak. Scutellum flat, elongate, rugosely striate. Posterior transverse carina of mesosternum very strongly raised, complete. Propodeum reticulate, without lateral protuberances, ventrally strongly sculptured; propodeum rather long, dorsally 0·90–1·10 times as long as broad.

Mid tibial spurs subequal, the outer about 1·10 times as long as the inner. Hind leg with basitarsus 0·65–0·70 times as long as tibia, 5·00–5·50 times as long as 2nd tarsal segment; 2nd tarsal segment 1·70–2·00 times as long as 3rd; trochanter 0·80–0·90 times as long as trochantellus ventrally; hind tarsal claw geniculate, strongly lobate. Hind tarsus 2 of male ventrally impressed on proximal 0·50 only.

Wings weakly infumate, CI = 0·75–0·95; MI = 1·65–1·75; ICI = 0·80–1·40; NI = 0·40–0·60. Forewing length 12–15 mm.

Gaster with tergite 2 2·00–2·20 times as long as tergite 3; ♀ with ovipositor 0·50–0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in apical cluster and with short row of paired spines on ventral margin. Aedeagus in profile equally bilobate; lateral sclerotized area apically truncate, lower corner ventrally extended.

Head black, lower face and orbits yellow; flagellum black, rarely distally paler. Thorax black, tegulae reddish. Anterior two pairs of legs dark brown, tibia centrally and tarsi pale yellow. Gaster reddish brown.

VARIATION. Some variation in colour, especially that of the extent of the yellow on the hind tibia, has been observed.

REMARKS. This species is morphologically closely related to *H. fulvitarse* which presumably it replaces in Borneo. Despite the close relationship the differences in pronotal sculpture and head shape will allow specific separation.

HOST RECORDS. None available.

DISTRIBUTION (Map 1). Recorded only from Borneo (Cameron, 1902; Szépligeti, 1905).

MATERIAL EXAMINED.

Anomalon perornatum Cameron, lectotype ♀, BORNEO: Sarawak, Kuchung, vii. 1899 (BMNH); paralectotype 1 ♀, BORNEO: xi. 1898 (*Shelford*) (BMNH).

BORNEO: 1 ♀, Sarawak, Kuchung, vi. 1902 (BMNH); 3 ♀, 1 ♂, 'Borneo' x. 1850 (*Hewitt*) (RSM); 1 ♂, Kalimantan, Midden, viii. 1925 (*Siebers*) (HKT).

Heteropelma ocypeta **sp. n.**

(Text-figs 10, 35)

[*Heteropelma perornatum* (Cameron); Gauld, 1976 : 28. Misidentification.]

This and the following two new species, *H. celeno* and *H. aello*, are named after the Harpyai of classical mythology, in whom are embodied the concepts of wind spirits and predatory ghosts.

DESCRIPTION. Lower face 0·60–0·65 times as broad as high; clypeus apically simply convex, in profile flattened; mandibles twisted about 35°, the upper tooth about 2·50 times as long as the lower. IOD about 1·30 times OOD; posterior ocellus separated from occipital carina by 1·30–1·40 times maximum ocellar diameter. Head strongly constricted posteriorly, vertex coriaceous; occipital carina evenly rounded dorsally. Flagellum of moderate length, 49-segmented; 1st flagellar segment 2·10–2·40 times as long as 2nd; interantennal lamella weak, in profile obtusely triangular. Face with long badious or rufescent pubescence.

Pronotum dorsally punctate, lower 0·40 longitudinally striate, anterior hook strong. Mesoscutum centrally coriaceous, laterally punctate; notauli weakly impressed but nevertheless obvious, extending beyond centre of mesoscutum; mesoscutal pubescence long, badious. Mesopleuron dorsally coriaceous, latero-ventrally sparsely punctate; epicnemial carina reaching above centre of mesopleuron, bowed so that upper end reaches anterior pleural margin; sternaulus weak. Scutellum flat, subquadrate, punctate. Posterior transverse carina of mesosternum strong, complete. Propodeum reticulate, without lateral protuberances, ventrally strongly sculptured; propodeum dorsally 0·85–0·95 times as long as broad.

Mid tibial spurs extremely inequal, the outer of normal length, the inner vestigial. Hind leg with basitarsus about 0·60 times as long as tibia, 4·10–5·10 times as long as 2nd tarsal segment; 2nd tarsal segment 1·40–1·70 times as long as 3rd; trochanter 0·90–0·95 times as long as trochantellus ventrally; hind tarsal claw geniculate, basally strongly lobate.

♂ unknown.

Wings weakly infumate, CI = 0·95–1·00; MI = 1·63–1·69; ICI = 0·80–1·00; NI = 0·40–0·60. Forewing length 9–10 mm.

Gaster with tergite 2 2·40 times as long as tergite 3; ♀ with ovipositor 0·45–0·55 times as long as tergite 2.

Head black, lower face and orbits yellow; flagellum reddish, proximally black, distally yellow. Anterior two pairs of legs yellow; hind legs brownish yellow, coxae and distal 0·40 of hind tibia black. Gaster reddish yellow, indistinctly infuscate in irregularly defined areas.

VARIATION. The paratype was observed to be somewhat more hirsute than the holotype. Possibly some of the hair on this specimen has been removed in the past by cleaning.

REMARKS. This species is similar in general morphology to *H. perornatum* but differs in having inequal mid tibial spurs, widely interspaced occipital carina and posterior ocelli, and having a more polished thorax.

HOST RECORDS. None available.

DISTRIBUTION (Map 1). Malaysia.

MATERIAL EXAMINED.

Holotype ♀, MALAYSIA: Pahang, Cameron Highlands, 1700 m, xii. 1939 (*Pendlebury*) (BMNH).

Paratype. MALAYSIA: 1 ♀, Pahang, Cameron Highlands, 1600 m, vi. 1935 (*Pendlebury*) (BMNH).

***Heteropelma celeno* sp. n.**

(Text-figs 11, 29, 32, 33, 47, 56, 57)

DESCRIPTION. Lower face 0·68–0·78 times as broad as high; clypeus apically simply convex, in profile more or less flat; mandibles twisted about 20°, the upper tooth about 2·00 times as long as lower. IOD 0·70–0·90 times as long as OOD; posterior ocellus separated from occipital carina by 0·90 times maximum ocellar diameter. Head strongly constricted, vertex closely but shallowly punctate; occipital carina dorsally flattened or slightly dipped. Flagellum of moderate length, 61- to 65-segmented; 1st flagellar segment 2·50–2·80 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with short pale pubescence.

Pronotum punctate to weakly coriaceous, anterior hook absent or vestigial. Mesoscutum coarsely and closely puncto-coriaceous, matt; notauli weak to indistinct; mesoscutal pubescence short, whitish. Mesopleuron dorsally alutaceous, latero-ventrally with fine even puncturation; epicnemial carina indistinct above lower corner of pronotum; sternaulus weak. Scutellum longitudinally concave, subquadrate, punctate. Posterior transverse carina of mesosternum complete, centrally weak. Propodeum reticulate with a pair of blunt lateral protuberances, ventrally weakly sculptured; propodeum dorsally 0·70–0·83 times as long as broad.

Mid tibial spurs subequal, the outer about 1·20 times as long as inner. Hind leg with basitarsus about 0·50 times as long as tibia, 2·40–2·80 times as long as 2nd tarsal segment; 2nd tarsal segment 1·70–2·10 times as long as 3rd; trochanter 0·70–0·90 times as long as trochantellus ventrally; hind tarsal claw abruptly curved, slender with a weak basal lobe. ♂ with 2nd hind tarsal segment strongly impressed ventrally.

Wings infumate, CI = 0·68; MI = 1·70–1·80; ICI = 0·30–0·90; NI = 0·20–0·30.

Gaster with tergite 2 about 2·50 times as long as tergite 3; ♀ with ovipositor 0·43–0·55 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in an apical cluster, some small spines distributed on clasping face. Aedeagus in profile apically very inequally bilobate; lateral sclerotized area apically simply acute.

Head, gaster and hind legs except for extreme distal end of basitarsus, tarsi 2–5 and coxae, black; lower face, orbits, extreme distal end of hind basitarsus and hind tarsi 2–5 white. Thorax, propodeum, anterior two pairs of legs and hind coxae reddish brown.

VARIATION. There was observed to be slight sexual dimorphism in this species. The males have the lower face immaculately white whereas that of the female has a pair of vertical black stripes extending from the anterior tentorial pits to the bases of the antennae. The hind tarsal claws of the males were observed to be slightly more slender than those of the females.

REMARKS. This and the following species, *H. aello*, are immediately distinguishable from other species of *Heteropelma* on account of their colour pattern. Unlike other species which are cryptically patterned these two species have bright warning coloration. This pattern is shared with three further synchronous and sympatric Papuan species, a species of *Aphanistes*, one of *Trichomma* and one of *Casinaria* (all are believed to be undescribed). Whilst ichneumonoid mimics of Aculeata are not uncommon (*Metopius* species mimic Eumenid wasps and many species of Ichneumonidae mimic Pompilid wasps (Evans, 1968)), this mimicry complex apparently involves no aculeates. As *H. celeno* is the most numerous species in Malaise trap collections (and is thus arguably the commonest species) it is likely to be the model for the mimicry complex. It is probable therefore that this species is unpalatable to predators. It is difficult working with preserved material to ascertain why this species should be so unpalatable, but unlike most other species it was observed to have large slender claws, which were observed to be apically strongly curved and appeared to have a cavity in the distal part. A similar cavity has been observed by Townes (1940) in some Pimplinae, and he suggested that the claws may function as organs of defence.

Townes suggested that the readiness with which the live insects grasped a net with their claws might indicate that it is their habit, when attacked, to embed their claws in a prospective predator. Because the cavity structurally weakens the claw, the distal portion of it would break off remaining embedded in the prospective predator. Simultaneously the contents of the cavity (possibly a toxin) would be liberated. *Heteropelma celeno* may well have evolved a similar defence mechanism. In the material examined a large number of specimens were observed to have the claws incomplete, indicating that claw fractures readily occur.

This species is obviously closely related to *H. aello* but the relationship of these species to the remainder of the genus is not at all clear.

HOST RECORDS. None available.

DISTRIBUTION. New Guinea.

MATERIAL EXAMINED.

Holotype ♀, NEW GUINEA: Wau & Mt Keinde, 2110 m, vi. 1969 (*Heinrich*) (HKT).

Paratypes. NEW GUINEA: 3 ♀, 8 ♂, NE., Mt Kaindi, 2350 m, vi. 1971 (*Sedlacek & Samuelson*) (BPBM); 7 ♀, 5 ♂, NE., Mt Kaindi, 2350 m, ix. 1966 (*Samuelson*) (BPBM); 1 ♂, NE., Bulldog Road, 2405 m, v. 1969 (*Sedlacek*) (BPBM); 1 ♀, Papua, Dimifa, 2200 m, x. 1958 (*Gressitt*) (BPBM); 1 ♀, 1 ♂, Papua, Mt Hagen, 2000 m, vi. 1969 (*Heinrich*) (HKT).

***Heteropelma aello* sp. n.**

(Text-figs 34, 53)

DESCRIPTION. Lower face 0·70–0·80 times as broad as high; clypeus apically simply convex, in profile weakly swollen; mandibles twisted about 40°, the upper tooth 2·50 times as long as lower. IOD 0·70–0·90 times as long as OOD; posterior ocellus separated from occipital carina by about 0·90 times maximum ocellar diameter. Head constricted, vertex with coarse scattered punctures; occipital carina medio-dorsally flattened. Flagellum of moderate length, 59- to 61-segmented; 1st flagellar segment 2·10–2·50 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with elongate black pubescence.

Pronotum coriaceous, anterior hook vestigial. Mesoscutum coarsely and very closely punctate, matt; notauli indistinct; mesoscutal pubescence short and dense, in ♀ badious, in ♂ testaceous. Mesopleuron dorsally coriaceous, latero-ventrally with fine even punctures;

epicnemial carina reaching about 0·40 of way up mesopleuron, its upper end widely separated from anterior pleural margin; sternaulus weak. Scutellum longitudinally concave, elongate, punctate. Posterior transverse carina of mesosternum broadly interrupted centrally. Propodeum reticulate with a pair of acute lateral protuberances, ventrally weakly sculptured; propodeum dorsally 0·56–0·66 times as long as broad.

Mid tibial spurs subequal, the outer about 1·20 times as long as the inner. Hind leg with basitarsus 0·50 times as long as tibia, 2·20–2·60 times as long as 2nd tarsal segment; 2nd tarsal segment 1·80–2·10 times as long as 3rd tarsal segment; trochanter 0·80–0·90 times as long as trochantellus ventrally; hind tarsal claw abruptly curved, unusually slender, with a small basal lobe. ♂ with 2nd hind tarsal segment ventrally strongly impressed.

Wings strongly infumate. CI = 0·80–0·90; MI = 1·50–1·75; ICI = 0·90–1·10; NI = 0·45–0·55. Forewing length 13–16 mm.

Gaster with tergite 2 2·30 times as long as tergite 3; ♀ with ovipositor 0·67 times as long as tergite 2.

♂ genitalia. Aedeagus in profile subequally bilobate; lateral sclerotized area apically simply acute.

Head, gaster, hind femora and basitarsi except distally, also usually ill defined areas on mesoscutum, pronotum and mesosternum blackish; face centrally usually, distal apex of hind basitarsus and hind tarsi 2–5 stramineous; thorax, propodeum, anterior two pairs of legs and hind coxae and trochanteral segments reddish brown.

VARIATION. The areas of black colour on the thorax were observed to be variable in their extent.

REMARKS. This species is apparently closely related to *H. celeno* from which it may be distinguished not only in the characters mentioned in the key but also in having a more strongly developed epicnemial carina, more strongly twisted mandibles and having the NI larger.

HOST RECORDS. None available.

MATERIAL EXAMINED.

Holotype ♀, NEW GUINEA: SE., Iongai, 1700–1900 m, 9.xi.1965 (*Sedlacek*) (BPBM).

Paratypes. NEW GUINEA: 1 ♂, NE., Lake Siruki, 2800–2900 m, 15.vi.1963 (*Sedlacek*) (BPBM); 1 ♂, SE., Mt Giluwe, 2500–3300 m, 2.vi.1963 (*Sedlacek*) (BPBM).

Heteropelma scaposum (Morley)

(Text-figs 30, 37, 49, 60, 64)

Exochilum scaposum Morley, 1913*a* : 75. Lectotype ♀, AUSTRALIA (BMNH), selected by Morley, designated by Townes *et al*., 1961 : 322 [examined].

Exochilum atrichiosoma Morley, 1913*a* : 77. Lectotype ♀, AUSTRALIA (BMNH), selected by Morley, designated by Townes *et al*., 1961 : 320 [examined]. [Synonymized by Gauld, 1974 : 543.]

Exochilum scaposum Morley; Turner, 1919 : 555.

Exochilum atrichiosoma Morley; Turner, 1919 : 555.

Heteropelma atrichiosoma (Morley) Townes *et al*., 1961 : 320.

Heteropelma scaposum (Morley) Townes *et al*., 1961 : 322.

Heteropelma scaposum (Morley); Gauld, 1974 : 543.

DESCRIPTION. Lower face 0·75–0·85 times as broad as high; clypeus apically almost truncate, in profile flat; mandibles not twisted, the upper tooth about 2·00 times as long as the lower;

IOD 1·20–1·40 times as long as OOD; posterior ocellus separated from occipital carina by about 1·20 times maximum ocellar diameter. Head not posteriorly constricted, vertex with deep scattered punctures; occipital carina mediodorsally flat or dipped. Flagellum moderately long, 48- to 58-segmented, 1st flagellar segment 2·20–2·60 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with pubescence short to long, always pale.

Propodeum punctate, anterior hook moderately well developed. Mesoscutum usually punctate; notauli weak but reaching beyond the centre of the scutum; mesoscutal pubescence usually short and pale. Mesopleuron dorsally rugose, latero-ventrally punctate; epicnemial carina reaching above centre of mesopleuron, bowed and with upper end close to anterior pleural margin; sternaulus moderately impressed, broad. Scutellum slightly convex in longitudinal profile, usually with a shallow concavity posteriorly, subquadrate, punctate. Posterior transverse carina of mesosternum complete, rarely rather weak centrally. Propodeum reticulate without lateral protuberances, ventrally sculptured; propodeum dorsally 0·70–0·90 times as long as broad.

Mid tibial spurs almost equal in length. Hind leg with basitarsus 0·50–0·60 times as long as tibia, 2·30–2·50 times as long as 2nd tarsal segment; 2nd tarsal segment 2·20–2·80 times as long as 3rd; trochanter 0·80–0·90 times as long as trochantellus ventrally; hind tarsal claws geniculate, basally lobate. ♂ with 2nd hind tarsal segment impressed ventrally.

Wings very weakly infumate. CI = 0·70–0·90; MI = 1·55–1·65; ICI = 0·85–1·20; NI = 0·50–0·60. Forewing length 6–15 mm.

Gaster with tergite 2 1·80–1·90 times as long as tergite 3; tergite 3 0·90 times or more (usually more than 1·00 times) as long as tergite 4; ♀ with ovipositor about 0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines scattered on clasping face. Aedeagus in profile apically somewhat obliquely truncate; lateral sclerotized area broad, apically indistinctly defined.

Head blackish; lower face and orbital marks yellow; antennae black to reddish, scape ventrally yellow. Thorax black, tegulae yellow. Anterior two pairs of legs yellow; hind legs red-brown, with dorsum of trochanter, trochantellus, distal apex of tibia and proximal end of basitarsus black; segments 2–4 and distal part of basitarsus yellow. Gaster reddish with dorsum of tergite 2 infuscate.

VARIATION. This species was observed to have one of the largest size ranges of any *Heteropelma* species. Smaller specimens were observed to have smaller values of CI than larger specimens. Larger specimens were also disproportionately more hairy, especially on the thorax. The shape of the head was observed to be rather variable. Examination of a long series of specimens from a number of localities has shown that specimens from coastal regions of the southern half of Australia are generally larger and with darker antennae than are those from Queensland. The type-material of *H. atrichiosoma* is merely a less yellow marked form of *H. scaposum*. A number of intermediates have been seen thus confirming the opinion that the former species is synonymous with the latter.

REMARKS. The basally dark basitarsus distinguishes the Australian species of *Heteropelma* from all others except the South American species. *H. scaposum* is closely related morphologically to *H. perniciosum* and *H. flavitarse*. It is distinct from the latter in having the hind tarsal claws geniculate and basally strongly lobate as well as being less hirsute and less extensively dark marked. It differs from *H. perniciosum* less markedly, indeed the only reliable features permitting separation are the relative lengths of the 3rd and 4th gastral tergites and the coloration. Whether these differences will remain when more material is available is yet to be ascertained.

H. scaposum is the commonest Australian Anomalonid and as a common parasite of *Heliothis armigera* may be an insect of considerable economic importance. As yet no worker has investigated the biology of this species.

It has been possible to examine the cephalic capsule of the final instar larva of this species. It was found to be similar to that of *H. calcator* except that the hypostoma was straighter and the labial sclerite more complete ventrally (Text-figs 36, 37).

HOST RECORDS. Girault (1925) recorded this species as a parasite of *Heliothis armigera* (Hübner). Specimens forwarded to the Commonwealth Institute of Entomology for identification are from:

Heliothis zea (Boddie) (=*obsoleta* F.) (*Ballard*, xii. 1925)
Heliothis armigera (Hübner) (Department of Agriculture, New South Wales, vi. 1974)
Omphaloides australasiae (F.) (*Williams*, vi. 1973).

DISTRIBUTION. Australia.

MATERIAL EXAMINED.

Exochilum scaposum Morley, lectotype ♀, AUSTRALIA: Queensland, Mackay (*Turner*) (BMNH); paralectotypes, 2 ♀, 4 ♂, same data as lectotype (BMNH). [In previous work (Gauld, 1974) only one ♀ paralectotype was mentioned; subsequently a further ♀ which must also be considered to be a paralectotype was discovered in the accessions of the BMNH. Morley failed to state the number of specimens upon which his description was based so that other paralectotypes may also exist.] *Exochilum atrichiosoma* Morley, lectotype ♀, AUSTRALIA: Victoria (*du Boulay*) (BMNH); paralectotypes 2 ♀, same data as lectotype (BMNH); 1 ♀ 'Western Australia'. [This specimen which bears no additional data, was labelled as 'co-type' by Morley. It is presumably the specimen or one of the specimens from Champion Bay, Western Australia, to which Morley refers. The specimens collected by French in 1901, which are also paralectotypes, have not been located.]

In addition to material listed by Gauld (1974) the following specimens have been examined: AUSTRALIA: 1 ♀, 4 ♂, Queensland, Biggenden (*H. Frauca*) (ANIC); 4 ♀, 3 ♂, Q., Brisbane, 1911–1913 (*H. Hacker*) (QM); 4 ♀, Q., 50 km west of Brisbane, ii. 1961 (*Gressitt*) (BPBM); 1 ♀, Q., Gatton, xii. 1925 (*Ballard*) (BMNH); 1 ♀, Q., Halifax, vi. 1919 (*B. Williams*) (BPBM); 4 ♂, Q., Mt Glorius (*Straatman*) (ANIC); 2 ♀, 1 ♂, Q., Mt Glorius, ii. 1961 (*Gressitt*) (BPBM); 1 ♂, Q., Mt Glorius, i. 1963 (*Brooks*) (BPBM); 1 ♂, New South Wales, Beechcroft, vi. 1973 (*Williams*) (BMNH); 1 ♂, Western Australia, Bejoording, ix. 1950 (*McMillan*) (WAM); 1 ♂, W.A., Carnac Is., ix. 1934 (*Norris*) (HKT); 2 ♀, 7 ♂, W.A., Coorow, 1952 (*McIntosh & Calaby*) (ANIC); 2 ♀, W.A., Cottesloe, ix. 1948 (*Glauret*) (WAM); 1 ♂, W.A., Cottesloe, xi. 1945 (*Glauret*) (WAM); 1 ♂, W.A., Dumbleyung, x. 1963 (*Udell*) (WAM); 5 ♀, 4 ♂, W.A., Merredin, x. 1952 (*Douglas*) (WAM); 2 ♀, 1 ♂, W.A., Mogamber, x. 1938 (*A. Turner*) (QM); 1 ♀, W.A., Nedlands, ix. 1963 (*Fuller*) (WAM); 2 ♀, W.A., Northam, xi. 1963 (*Sedlacek*) (BPBM); 1 ♀, W.A., Nukarni, ix. 1948 (*Willis*) (WAM); 1 ♀, 6 ♂, W.A., Rottnest Is., 1936/7 (*Glauret*) (WAM); 2 ♀, W.A., Yallingup, xi. 1942 (*Glauret*) (WAM); 2 ♀, Tasmania, Hobart, i. 1934 (*A. Turner*) (QM); 1 ♀, T., Launceston, ii. 1916 (*Littler*) (QM).

Heteropelma flavitarse (Brullé)

(Text-fig. 31)

Anomalon flavitarse Brullé, 1846 : 171. Holotype ♂, AUSTRALIA (lost).
Anomalon trichiosomum Cameron, 1906 : 182. Holotype ♀, AUSTRALIA (BMNH). [Synonymized by Gauld, 1974 : 542.]
Exochilum trichiosoma (Cameron) Morley, 1913*a* : 77.
Barylypa flavitarsis (Brullé) Morley, 1913*a* : 81.
Heteropelma? flavitarse (Brullé) Townes *et al.*, 1961 : 321.
Heteropelma trichiosomum (Cameron) Townes *et al.*, 1961 : 322.
Heteropelma flavitarse (Brullé) Gauld, 1974 : 542.

DESCRIPTION. Lower face 0·70–0·80 times as broad as high; clypeus subtruncate apically, in profile flat; mandibles not twisted, upper tooth about 2·50 times as long as lower; IOD 1·20–1·30 times OOD; posterior ocellus separated from occipital carina by a distance about equal to the maximum ocellar diameter. Head not posteriorly constricted, vertex punctate; occipital carina mediodorsally flattened. Flagellum of moderate length, stout, 60- to 65-segmented; 1st flagellar segment 2·80–3·00 times as long as 2nd; interantennal lamella strong, in profile almost quadrate. Face with long badious pubescence.

Pronotum punctate, anterior hook weak. Mesoscutum punctate; notauli weak, reaching to centre of scutum but not discernible at anterior extremities; mesoscutal pubescence blackish. Mesopleuron dorsally coriaceous, ventrolaterally coarsely punctate; epicnemial carina not reaching above lower 0·4 of mesopleuron, its upper end not close to anterior pleural margin; sternaulus moderately strong. Scutellum moderately convex, subquadrate, rugosely punctate. Posterior transverse carina of mesosternum complete. Propodeum finely reticulate, without lateral projections, ventrally sculptured; propodeum dorsally 0·70–0·80 times as long as broad.

Mid tibial spurs equal. Hind leg with basitarsus 0·50–0·60 times as long as tibia, 2·50–2·80 times as long as 2nd tarsal segment; 2nd tarsal segment 2·20–2·30 times as long as 3rd; trochanter about 0·80 times as long as trochantellus ventrally; hind tarsal claws simply curved with a weak basal lamella. Male with 2nd hind tarsal segment ventrally impressed.

Wings moderately infumate; CI = 0·80–0·85; MI = 1·50–1·60; ICI = 1·00–1·20; NI = 0·40–0·50. Forewing length 13–16 mm.

Gaster with tergite 2 1·90–2·00 times as long as tergite 3; tergite 3 about 1·10 times as long as tergite 4. ♀ with ovipositor 0·60–0·65 times as long as tergite 2. ♂ genitalia similar to those of *H. scaposum*.

Head black, lower face centrally (rarely entirely) and small mark on vertex yellow; flagellum black, scape indistinctly red ventrally. Thorax black, tegulae red. Legs red-brown, forelegs paler; hind tibiae, except proximally, and hind basitarsus proximally black; hind tarsi 2–4 yellowish. Gaster dark red, dorsally and ventrally infuscate.

VARIATION. Some variation in the facial colour was observed. The black areas are typically present as a pair of stripes extending from tentorial pits to antennal bases, but these stripes vary in width until in extreme cases the entire lower face is black except for a small central yellow mark. In other cases the width of the stripes is reduced and in isolated specimens the stripes were not discernible except as small infuscate areas above the anterior tentorial pits and below the antennal bases. Males were generally observed to have the face less black marked than females.

REMARKS. The tarsal claws, ratio of hind tarsal lengths, clypeal structure and head shape would seem to indicate that this species is one of the least specialized species of *Heteropelma*. This observation is discussed further below (p. 206). This species is probably closely related to the other Australian species.

HOST RECORDS. None known.

DISTRIBUTION (Map 2). This species is apparently restricted to the southern part of Australia and Tasmania.

MATERIAL EXAMINED.

Anomalon trichiosomum Cameron, holotype ♀, AUSTRALIA: no further data (BMNH).

In addition to the material listed by Gauld (1974) the following specimens have been examined: AUSTRALIA: 1 ♀, Tasmania, Eaglehawk Neck, ii. 1913 (*R. E. Turner*) (HKT); 2 ♂, Western Australia, Guildford, viii. 1962 (*McMillan*) (WAM); 1 ♂, W.A., Kings Park, iv. 1974 (*Postmus & Wade*) (WAM); 1 ♀, W.A., Norrogin, x. 1936 (*Douglas*) (WAM); 1 ♀, W.A., Yallingup, x. 1913 (*R. E. Turner*) (BMNH).

Heteropelma perniciosum (Turner)

Exochilum perniciosum Turner, 1919 : 554. Lectotype ♀, AUSTRALIA (BMNH), designated by Gauld, 1974 : 544 [examined].
Heteropelma perniciosum (Turner) Townes *et al.*, 1961 : 321.
Heteropelma perniciosum (Turner); Gauld, 1974 : 544.

DESCRIPTION. Lower face 0·60–0·65 times as broad as high; clypeus apically simply convex, in profile slightly swollen; mandibles not twisted, upper tooth about 1·80 times as long as lower. IOD 1·20–1·30 times as long as OOD; posterior ocellus separated from occipital carina by about 1·20 times ocellar diameter. Head weakly constricted posteriorly, vertex sparsely but deeply punctate; occipital carina mediodorsally evenly rounded. Flagellum moderately long, 45- to 48-segmented; 1st flagellar segment about 2·00 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with long sparse pubescence.

Pronotum coriaceous, anterior hook strong. Mesoscutum coarsely punctate; notauli weak but discernible beyond centre of mesoscutum; mesoscutal pubescence short and pale. Mesopleuron coriaceous, latero-ventrally closely punctate; epicnemial carina reaching to centre of pleuron, bowed so that upper end approaches anterior pleural margin; sternaulus weak. Scutellum longitudinally concave, elongate, coarsely puncto-striate. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral projections, ventrally sculptured; propodeum dorsally about 0·80 times as long as broad.

Mid tibial spurs equal. Hind leg with basitarsus about 0·55 times as long as tibia, 2·10–2·20 times as long as 2nd tarsal segment; 2nd tarsal segment 2·40 times as long as 3rd; trochanter 0·80 times as long as trochantellus ventrally; hind tarsal claws geniculate, with strong basal lamella. Male unknown.

Wings very weakly infumate; CI = 0·80–0·85; MI = 1·50–1·60; ICI = 1·10–1·20; NI = 0·50. Forewing length 8–9 mm.

Gaster with tergite 2 about 2·40 times as long as tergite 3; tergite 3 0·70–0·80 times as long as tergite 4. ♀ with ovipositor about 0·60 times as long as tergite 2.

Head black, lower face, marks on vertex and genae reddish; antennae red, proximally darker. Thorax reddish brown, mesoscutum and mesosternum black marked. Legs red, hind tibia distally and basitarsus proximally black. Gaster unicolorous red.

REMARKS. The validity of this species must remain questionable for several reasons. Firstly, the two females are very similar to *H. scaposum*, differing only in colour and relative lengths of tergites 3 and 4. Secondly, although extensive collections of Australian specimens have been examined, no further examples of this species have been seen. However, as the fauna of Western Australia is as yet only poorly collected it is conceivable that this species has been overlooked by all collectors since Turner. In the present work, therefore, *H. perniciosum* is provisionally retained as a distinct species.

HOST RECORDS. None available.

DISTRIBUTION. Australia (Western Australia only).

MATERIAL EXAMINED.

Exochilum perniciosum Turner, lectotype ♀, AUSTRALIA: Western Australia, Yallingup (*Turner*) (BMNH); paralectotype 1 ♀, same data as lectotype (BMNH).

Heteropelma quodi (Vachal)

(Text-figs 7, 45)

Anomalon quodi Vachal, 1907 : 120. Holotype ♂, NEW CALEDONIA (?MNHN).
Heteropelma quodi (Vachal) Townes *et al.*, 1961 : 321.

The Vachal types are all believed to be in the MNHN, Paris. Mme Kelner-Pillault was so kind as to search for the holotype of *H. quodi* and, although she located the type-material of other species described by Vachal in the same publication, she was unable to locate that of *H. quodi*. I have before me a pair of specimens of this distinct species, the male of which agrees exactly with the description given by Vachal (1907). The descriptions below are based on these specimens.

DESCRIPTION. Lower face 0·62–0·66 times as broad as high; clypeus apically simply convex, in profile almost flat; mandibles twisted about 40°, the upper tooth about 3·00 times as long as the lower. IOD 1·30–1·50 times as long as OOD; posterior ocellus separated from occipital carina by a distance about equal to an ocellar diameter. Head constricted, vertex coarsely but not closely punctate; occipital carina medio-dorsally weakly flattened. Flagellum of moderate length, 51- to 53-segmented; 1st flagellar segment 1·90–2·10 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with moderately long pale pubescence.

Pronotum strongly punctate, anterior hook moderately developed. Mesoscutum coarsely punctate, subpolished; notauli strongly impressed, reaching beyond centre of scutum; mesoscutal pubescence short, badious. Mesopleuron dorsally rugose, latero-ventrally with numerous finely regularly interspaced punctures; epicnemial carina strong, its upper end not reaching to centre of pleuron and separated from anterior pleural margin; sternaulus weak. Scutellum weakly convex, somewhat elongate, coarsely punctostriate. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral protuberances, ventrally strongly carinate; propodeum dorsally 0·80 times as long as broad.

Mid tibial spurs subequal, the outer about 1·20 times as long as the inner. Hind leg with basitarsus 0·50 times as long as tibia, 2·20–2·50 times as long as 2nd tarsal segment; 2nd tarsal segment 1·80–2·30 times as long as 3rd tarsal segment; trochanter ventrally 0·70 times as long as trochantellus; hind tarsal claw geniculate, with moderately developed basal lobe. ♂ with 2nd hind tarsal segment ventrally impressed.

Wings blackish; CI = 0·80–0·90; MI = 1·45–1·65; ICI = 1·20–4·00; NI = 0·55–0·65. Forewing length 9–10 mm.

Gaster with tergite 2 about 2·10 times as long as tergite 3; ♀ with ovipositor 0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in apical cluster and with a short row of double spines on ventral margin. Aedeagus in profile apically subequally bilobate; lateral sclerotized area apically indistinctly defined.

Insect predominantly black, lower face, marks on genal orbits, anterior two pairs of legs (except for the coxae partially) and hind tarsi (except basitarsus proximally) yellow.

VARIATION. The ♀ was observed to have the fore coxae darker than the ♂.

REMARKS. The form of the hind legs and head shape indicate that this species is closely related to the Australian species. It is quite distinct from the Papuan species-group in having a simple propodeum and an obvious pronotal hook. Gupta (1962) found in the Ichneumonid genus *Theronia* a close relationship between Australian and New Caledonian species and a similar relationship has been observed in species of the genus *Agrypon* (Gauld, unpublished data). This data would seem to indicate that although New Caledonia is often placed in the Papuan zoogeographic region at least part of its fauna has been derived, possibly through chance migration, from mainland Australia and not from New Guinea via the Solomon Archipelago.

HOST RECORDS. None available.

DISTRIBUTION. New Caledonia.

MATERIAL EXAMINED.

NEW CALEDONIA: 1 ♀, Foret de Thi, ii. 1957 (*Rageau*) (BMNH); 1 ♂, Mt Koghi, x. 1967 (*Sedlacek*) (BPBM); 1 ♂, Bourail, xii. 1930 (*Cheesman*) (BMNH).

Heteropelma savaiiense (Fullaway)

(Text-figs 9, 25, 39)

Therion savaiiense Fullaway, 1940 : 400. Holotype ♂, SAMOAN ISLANDS (BPBM) [examined].
Heteropelma savaiiense (Fullaway) Townes *et al.*, 1961 : 322.

DESCRIPTION. Lower face 0·63 times as broad as high; clypeus apically simply convex, in profile weakly swollen; mandibles twisted about 35°, the upper tooth more than 2·00 times as long as the lower. IOD 1·10 times as long as OOD; posterior ocellus separated from occipital carina by 1·10 times maximum ocellar diameter. Head somewhat constricted, vertex coarsely punctate; occipital carina dorsally slightly flattened. Flagellum incomplete, 1st flagellar segment 1·90 times as long as 2nd; interantennal lamella weak, in profile obtusely triangular. Face with short sparse pubescence.

Pronotum granulate, anterior hook weak. Mesoscutum very coarsely rugose, matt; notauli strongly impressed, reaching to centre of scutum; mesoscutal pubescence short, white. Mesopleuron dorsally rugose, latero-ventrally sparsely punctate; epicnemial carina strong, close to anterior margin of pleuron, its upper end reaching pleural margin slightly above the centre of the mesopleuron; sternaulus strongly impressed. Scutellum weakly convex, subquadrate, punctostriate. Posterior transverse carina of mesosternum complete, centrally somewhat faint. Propodeum reticulate, without lateral projections, ventrally with strong carinae; propodeum dorsally 0·80 times as long as broad.

Mid tibial spurs subequal, the outer 1·30 times as long as the inner. Hind leg with basitarsus 0·50 times as long as tibia, 2·40 times as long as 2nd tarsal segment; 2nd tarsal segment 1·90 times as long as 3rd segment; trochanter 0·90 times as long as trochantellus ventrally; hind tarsal claw geniculate, with weak basal lobe; tarsus 2 ventrally impressed.

Wings hyaline: CI = 0·85; MI = 1·95; ICI = 0·25; NI = 0·26. Forewing length 7·5 mm.

Gaster with tergite 2 1·60 times as long as tergite 3.

♀ unknown.

♂ genitalia. Not available for dissection.

Insect entirely orange-red except for the lower face, genae and anterior two pairs of legs, which are yellowish, and the frons and vertex, which are brown.

REMARKS. This species is probably closely related to *H. quodi*. Very little collection of Ichneumonidae has been undertaken in the islands east of New Guinea. *Heteropelma* species have been found on two groups, New Caledonia and Samoa. It is possible that a number of other species await discovery in this general area.

HOST RECORDS. None available.

DISTRIBUTION. Samoan Islands.

MATERIAL EXAMINED.

Holotype ♂, SAMOAN ISLANDS: Savaii, Safune, 650–1300 m, rain forest, v. 1924 (*E. Bryan*) (BPBM).

Heteropelma townesi **sp. n.**

(Text-figs 8, 40, 43, 51)

This species is named after Dr H. K. Townes who was kind enough to inform the author of the existence of this Neotropical species.

DESCRIPTION. Lower face 0·60–0·70 times as broad as high; clypeus apically rather flatly convex, in profile weakly swollen; mandibles twisted about 40°, the upper tooth about 3·00 times as long as the lower. IOD about 1·00 times as long as OOD; posterior ocellus separated from occipital carina by about 1·10 times maximum ocellar diameter. Head constricted, vertex with scattered punctures, medio-dorsally rugose; occipital carina incomplete medio-dorsally. Flagellum of moderate length, 45- to 47-segmented; 1st flagellar segment 1·90–2·50 times as long as 2nd; interantennal lamella moderately strong, in profile more or less triangular. Face with short pale pubescence.

Pronotum polished with very fine scattered punctures and with strongly impressed margins; anterior hook moderately developed. Mesoscutum polished, evenly punctate, punctures separated by their own diameters; notauli distinct, nearly reaching to posterior margin of mesoscutum; mesoscutal pubescence short, pale. Mesopleuron dorsally longitudinally striate, latero-ventrally finely punctate; epicnemial carina reaching to centre of mesopleuron, bowed so that upper end reaches anterior pleural margin; sternaulus weak. Scutellum longitudinally concave, subquadrate, punctate. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral protuberances; propodeum dorsally 0·70–0·75 times as long as broad.

Mid tibia unicalcarate. Hind leg with basitarsus 0·50–0·60 times as long as tibia, 1·80–3·80 times as long as 2nd tarsal segment; 2nd tarsal segment 2·10–3·50 times as long as 3rd segment; trochanter 1·00–1·05 times as long as trochantellus ventrally; hind tarsal claw strongly geniculate, basally lobate; ♂ with hind tarsus 2 with a groove-like ventral impression.

Wings infumate; CI = 0·40–0·55; MI = 2·10–2·40; ICI = 0·70–1·10; NI = 0·70–0·90. Forewing length 10–14 mm.

Gaster with tergite 2 about 2·30 times as long as tergite 3; ♀ with ovipositor 0·50–0·60 times as long as tergite 2.

♂ genitalia. Aedeagus in profile with dorsal lobe strongly reduced; lateral sclerotized region narrow, apically rounded.

Insect almost entirely black, yellow marked on lower face, genae, fore legs (except tarsi distally), mid legs (except coxae proximally, distal 0·50 of femur, tibia on proximal 0·10 and distal 0·40 and tarsi 2–4), ventral surface of hind trochantellus and band on proximal third of hind tibia; gaster indistinctly reddish brown in part.

VARIATION. There was observed to be an unusual degree of variation in the ratio of the first two hind tarsal segments of this species. One of the females examined, and subsequently not included as a paratype, was observed to be smaller than the holotype and have a red marked gaster. This specimen is also unusual in having a transverse impression dorsally on each hind femur. Whether this is a teratological aberration, or within the normal range of variation for this species is not known. It is possible that this specimen may represent a second and undescribed Neotropical species.

REMARKS. This species is morphologically quite distinct in having the mid tibia unicalcarate, occipital carina incomplete, trochanters equal to or longer than the trochantelli, etc. However, when compared with the Therionini as a whole it is obvious from the form of the clypeus, form of the hind tarsi, structure of the ovipositor and shape of the claws that this species is an aberrant species of *Heteropelma* and does not warrant further taxonomic distinction. The affinities of this species are not clear but the structure of the legs and clypeus would seem to indicate that this species may be allied to the *H. calcator* species-group. Alternatively it is possible that this species may be closer to some of the Australasian species and have developed the elongate tarsi quite separately from the *calcator*-group. Whatever its ancestry, this species has obviously been separated from the main group of species for a considerable period. This species is not at all closely related to the Nearctic species.

HOST RECORDS. None available.

DISTRIBUTION (Map 2). Brazil.

MATERIAL EXAMINED.

Holotype ♀, BRAZIL: Nova Teutonia, Santa Catarina, xi. 1970 (*Plaumann*) (HKT).

Paratypes. 1 ♂, BRAZIL: Nova Teutonia, Santa Catarina, xi. 1968 (*Plaumann*) (HKT); 1 ♂, Nova Teutonia, xii. 1938 (*Plaumann*) (BMNH).

Material excluded from type-series. BRAZIL: 1 ♀, Nova Teutonia, Santa Catarina, xi. 1970 (*Plaumann*) (HKT).

Heteropelma datanae Riley

(Text-figs 26, 54)

Anomalon flavicorne Brullé, 1846 : 171. Holotype ♀, U.S.A.: Philadelphia (?MNHN). Junior primary homonym of *Anomalon flavicorne* Say, 1823.

Heteropelma flavicorne (Brullé) Norton, 1863 : 360.

Heteropelma datanae Riley, 1888 : 177. LECTOTYPE ♀, U.S.A. (USNM), by present designation [examined].

Heteropelma flavicorne (Brullé); Ashmead, 1900 : 581.

Heteropelma datanae Riley; Ashmead, 1900 : 581.

[*Heteropelma fulvicorne* (Say); Morley, 1913*a* : 68. Misidentification and incorrect spelling.]

Heteropelma datanae Riley; Morley, 1913*a* : 69.

Heteropelma flavicorne (Brullé); Viereck, 1917 : 285.

Heteropelma flavicorne (Brullé); Schaffner & Griswold, 1934 : 145.

Heteropelma datanae Riley; Schaffner & Griswold, 1934 : 145.

Heteropelma datanae Riley; Haseman, 1940 : 12.
Heteropelma fulvicorne Townes, 1945 : 729. Replacement name for *flavicorne* Brullé. Junior secondary homonym of *Heteropelma fulvicorne* (Cameron), 1899 : 104. **Syn. n.**
Heteropelma fulvicorne Townes; Townes, 1951 : 401.
Tanypelma fulvicorne (Townes) Townes, 1971 : 157.
Tanypelma datanae (Riley) Townes, 1971 : 157.

DESCRIPTION. Lower face 0·80–0·90 times as broad as high; clypeus apically simply convex, in profile flat; mandibles unusually stout, not twisted, the upper tooth subequal in length to the lower. IOD 0·70–0·80 times as long as OOD; posterior ocellus separated from occipital carina by more than 1·50 times ocellar diameter. Head slightly to strongly buccate posteriorly, vertex finely punctate; occipital carina mediodorsally evenly rounded. Flagellum of moderate length, 46- to 55-segmented; 1st flagellar segment 1·65–1·75 times as long as 2nd; interantennal lamella moderately strong, in profile triangular. Face with short pale pubescence.

Pronotum rugosely punctate, anterior hook strong. Mesoscutum punctate, notauli weakly impressed but discernible beyond centre of mesoscutum; mesoscutal pubescence short, pale yellowish. Mesopleuron rather evenly punctate except for smooth postero-dorsal region; epicnemial carina not reaching above lower 0·35 of mesopleuron, not reaching anterior pleural margin; sternaulus weak. Scutellum very convex, rugose. Posterior transverse carina of mesosternum complete. Propodeum reticulate, without lateral projections, ventrally sculptured; propodeum dorsally rather short, 0·60–0·75 times as long as broad.

Mid tibial spurs subequal. Hind leg with basitarsus 0·70–0·85 times as long as tibia, 5·00–6·00 times as long as 2nd tarsal segment; 2nd tarsal segment about 2·00 times as long as 3rd; trochanter about 0·85 times as long as trochantellus ventrally; hind tarsal claw geniculate, basally lobate; ♂ with hind tarsus 2 not ventrally impressed, without broadened macrotrichia but often with densely packed microtrichia.

Wings infumate; CI = 0·90–1·05; MI = 1·35–1·55; ICI = 0·60–2·20; NI = 0·75–0·95. Forewing length 12–17 mm.

Gaster with tergite 2 1·65–1·75 times as long as tergite 3; ♀ with ovipositor about 0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines on ventral side of a median ridge. Aedeagus in profile apically subequally bilobate; lateral sclerotized region very broad, apically dilated, indistinctly delineated.

COLOUR VARIATION. In the southern U.S.A. and in the south-east to about 42°N specimens are reddish brown with the lower face and legs distally paler, whilst in the north-eastern U.S.A. specimens are almost entirely black with only the flagellum yellowish.

REMARKS. Examination of material of this species presented a problem not uncommonly encountered in taxonomy. Specimens from lower latitudes are consistently paler coloured than those from the north. Previously the paler form was called *datanae* whilst the darker specimens were considered to be a separate species, *fulvicorne* Townes. Some authors when encountering similar variation in other Hymenoptera have retained the forms as distinct subspecies (Townes, 1957 : 253–256). In the present case the author has not used the subspecies category for the following reasons.

1. Many species of *Heteropelma* with a wide range of geographical distribution exhibit continuous clinal variation in coloration (see p. 168).

2. Both *datanae* and *fulvicorne* are parasites of *Datana* species; indeed both are recorded as parasitizing *D. integerrima* Grote & Robinson (Townes, 1951).

3. The geographical ranges of the two broadly overlap. An unpublished manu-

script by A. B. Gahan (deposited in the USNM) records *fulvicorne* from Virginia whilst *datanae* is recorded as far north as New York.

4. Specimens intermediate between the two colour extremes occur. In the BMNH is a black ♀ with a pale brown face and a ♂ (from New York) with the thorax and most of the gaster black, but with the lower face yellow and the central segments of the gaster and hind legs brown. 1 ♂ from Georgia (UM, Oxford) is uniformly dark brown with the hind legs black and the lower face pale brown.

Some authors regard intergrades between their subspecies as inevitable when there is no geographical barrier present. For example Betrem & Bradley (1971 : 11) when discussing Ethiopian Scoliidae state 'if a species is constantly different from that in an adjoining region it deserves, in our opinion, a subspecific name; the occurrence of intergrades in an intermediate region is to be expected and is not contradictory'. Whilst not wishing to comment on the taxonomic judgement of these authors it must be pointed out that because of the existence of the intergrades in an intermediate region, one extreme population (subspecies) does not adjoin the other extreme population (subspecies) but adjoins the intermediate intergrades from which it does not differ constantly. Such is the case with *H. datanae*. One of the main objects of any taxonomic work must be the production of a workable key to the taxa discussed. If, in the present case, two subspecies of *datanae* were recognized on colour characters, any given key would not work for the intergrades (some 15% of material examined). These specimens would therefore remain indeterminable. The only way the author considers that this can be avoided is by the use of a single taxon, the species *H. datanae*, and including within it the complete range of colour variation.

HOST RECORDS. Townes (1951) records this species as a parasite of *Datana contracta* Walker, *D. integerrima* Grote & Robinson, *D. ministra* (Drury) and *D. perspicua* Grote & Robinson. Ashmead (1900) records it from *Sphinx luscitiosa* Clemens.

DISTRIBUTION (Map 2). U.S.A. east of 100°W.

MATERIAL EXAMINED.

Heteropelma datanae Riley, lectotype ♀, U.S.A.: Virginia, viii. 1880, ex *Datana integerrima* (*T. Pergande*) (USNM). Paralectotypes, 3 ♀, 2 ♂, 1 damaged specimen not sexed, same data as lectotype (USNM); 1 ♀, same data as lectotype (BMNH).

U.S.A.: 1 ♂, Georgia, no further data (UM); 1 ♀, New York, Wappinger Falls, x. 1934 (BMNH); 1 ♀, 1 ♂, New York, no further data (BMNH); 1 ♀, New Hampshire, Monacknock, 1911 (BMNH); 1 ♀, 1 ♂, Rhode Island, Westerley, viii. 1951 (*H. & M. Townes*) (BMNH); 1 ♀, 1 ♂, same data (HKT); 2 ♂, 'America', no further data (BMNH).

Heteropelma nigricorne (Szépligeti) **comb. n.**

(Text-figs 26, 54)

Schizoloma nigricorne Szépligeti, 1906 : 125. Lectotype ♀, INDIA (TM), designated by Townes *et al.*, 1961 : 323 [examined].
Schizoloma nigricorne Szépligeti; Townes *et al.*, 1961 : 323.

DESCRIPTION. Lower face 0·80–0·85 times as broad as high; clypeus angularly rounded, with weak lateral protuberances, in profile swollen; mandibles not twisted, the upper tooth about 2·00 times as long as the lower. IOD 0·60 times as long as OOD; posterior ocellus separated from occipital carina by about 1·00 times maximum ocellar diameter. Head not obviously constricted posteriorly; vertex punctate; occipital carina medio-dorsally evenly rounded, often rather weak. Flagellum elongate, 54- to 55-segmented; 1st flagellar segment 2·30–2·50 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with elongate pale pubescence.

Pronotum coriaceous, anterior hook strong. Mesoscutum coarsely punctate; notauli moderately impressed, discernible to centre of scutum; mesoscutal pubescence short and pale. Mesopleuron dorsally reticulate, latero-ventrally punctate; epicnemial carina reaching about 0·30 of way up mesopleuron, its upper end distant from anterior pleural margin; sternaulus vestigial. Scutellum longitudinally concave, elongate, punctate. Posterior transverse carina of mesosternum complete. Propodeum coarsely reticulate, without lateral projections, ventrally sculptured; propodeum dorsally about 0·70 times as long as broad.

Mid tibial spurs subequal, the outer about 1·10 times as long as the inner. Hind leg with basitarsus 0·50 times as long as tibia, 2·30–2·40 times as long as 2nd tarsal segment; 2nd tarsal segment 2·90–3·00 times as long as 3rd segment; trochanter subequal to trochantellus ventrally; hind tarsal claws moderately curved, with a weak basal lobe.

Wings infumate; CI = 0·75–0·85; MI = 1·60–1·70; ICI = 0·50–0·60; NI = 0·45–0·55. Forewing length 12–13 mm.

Gaster with tergite 2 2·00–2·10 times as long as tergite 3; ♀ with ovipositor 0·70 times as long as tergite 2.

♂ unknown.

Head black, lower face and marks on genal orbit yellow; flagellum blackish. Thorax and propodeum black, tegulae reddish brown. Legs yellowish brown; anterior two pairs paler than hind pair; hind two pairs of coxae infuscate, hind tibia distally black.

REMARKS. This species is similar to some variants of *H. amictum*, especially those which have the lateral clypeal protuberances reduced. However, a number of characters combined in this species have not been observed either to occur at all or in this combination in *H. amictum*. The lower face of this species is more quadrate than that of *H. amictum*. This character combined with the colour of antennae, unusually small value of IOD compared to OOD, complete lack of vertical yellow marks and characteristic clypeal shape serve to distinguish this species from others.

HOST RECORDS. None available.

DISTRIBUTION (Map 2). India (peninsular).

MATERIAL EXAMINED.

Lectotype ♀, INDIA: Matheran, 800 m, 1902 (*Biro*) (TM). Paralectotypes, 2 ♀, same data as lectotype (TM).

Heteropelma amictum (F.)

(Text-figs 12, 13, 16, 17, 18, 42, 46, 61)

Ichneumon amictus Fabricius, 1775 : 341. Holotype ♀ (no further data) (BMNH) [examined].
Ophion amictus (F.) Fabricius, 1798 : 237.
Anomalon amictum (F.) Gravenhorst, 1829 : 650.
Anomalon (*Schizoloma*) *amictum* (F.) Wesmael, 1849 : 120.

Anomalon capitatum Desvignes, 1856 : 104. Lectotype ♂, Great Britain: England (BMNH) designated by Fitton (1976 : 324) [examined]. **Syn. n.**

Schizoloma bucephalum Brauns, 1898 : 71. Holotype ♂ (no further data) (?lost). [Synonymized by Schmiedeknecht, 1908 : 1463.]

Schizoloma fulvicorne Cameron, 1899 : 104. LECTOTYPE ♂, India (UM), here designated [examined]. **Syn. n.**

Anomalon tinctipenne Cameron, 1899 : 112. LECTOTYPE ♀, India (UM), here designated [examined]. **Syn. n.**

[*Anomalon perornatum* Cameron; Szépligeti, 1905 : 12. Misidentification.]

Schizoloma capitata (Desvignes) Szépligeti, 1905 : 34.

Schizoloma amictum (F.); Schmiedeknecht, 1908 : 1462.

Schizoloma capitata (Desvignes); Schmiedeknecht, 1908 : 1463.

Schizoloma amicta (F.); Morley, 1913*a* : 67.

Schizoloma capitata (Desvignes); Morley, 1913*a* : 67.

Schizoloma fulvicornis Cameron; Morley, 1913*a* : 67.

Exochilum acheron Morley, 1913*a* : 79. LECTOTYPE ♀, India (BMNH), here designated [examined]. **Syn. n.**

Anomalon tinctipenne Cameron; Morley, 1913*a* : 83.

Schizoloma fulvicornis Cameron; Morley, 1913*b* : 403.

Schizoloma amictum (F.); Morley, 1913*b* : 404.

Exochilum acheron Morley; Morley, 1913*b* : 412.

Exochilum acheron var. *scutellatum* Morley, 1913*b* : 412. Syntypes ♀ & ♂, India (?Calcutta) [not examined]. **Syn. n.**

Anomalon tinctipenne Cameron; Morley, 1913*b* : 422.

Schizoloma amictum (F.); Morley, 1915 : 276.

Schizoloma capitatum (Desvignes); Morley, 1915 : 227.

Habronyx sachalinensis Matsumura, 1918 : 116. Holotype ♀, Sakhalin (EIHU) [not examined]. [Synonymized by Uchida, 1928 : 233.]

Schizoloma crassicalx Enderlein, 1921 : 11. Holotype ♂, Sumatra (IZPAN) [examined]. **Syn. n.**

Schizoloma amictum (F.); Uchida, 1928 : 233.

Schizoloma amictum var. *nigricoxalis* Uchida, 1928 : 234. Lectotype ♀, Sakhalin (EIHU), designated by Townes *et al.*, 1965 : 383 [not examined]. [Synonymized by Uchida, 1958 : 91.]

Schizoloma amictum var. *intermedium* Uchida, 1928 : 234. Lectotype ♂, Japan (EIHU), designated by Townes *et al.*, 1965 : 383. [Synonymized by Uchida, 1958 : 91.]

Schizoloma coreanum Uchida, 1928 : 235. LECTOTYPE ♂, Korea (EIHU), here designated [examined]. **Syn. n.**

Schizoloma amictum (F.); Schmiedeknecht, 1936 : 63.

Schizoloma capitatum (Desvignes); Schmiedeknecht, 1936 : 64.

Schizoloma amictum (F.); Uchida, 1958 : 90.

Schizoloma coreanum Uchida; Uchida, 1958 : 91.

Schizoloma amictum (F.); Townes *et al.*, 1961 : 322.

Schizoloma capitatum (Desvignes); Townes *et al.*, 1961 : 323.

Schizoloma crassicalx Enderlein; Townes *et al.*, 1961 : 323.

Schizoloma fulvicorne Cameron; Townes *et al.*, 1961 : 323.

Schizoloma tinctipenne (Cameron) Townes *et al.*, 1961 : 323.

Heteropelma acheron (Morley) Townes, Momoi & Townes, 1965 : 382.

Schizoloma amictum (F.); Townes, Momoi & Townes, 1965 : 383.

Schizoloma capitatum (Desvignes); Townes, Momoi & Townes, 1965 : 384.

Schizoloma coreanum Uchida; Townes, Momoi & Townes, 1965 : 385.

Heteropelma amictum (F.) Townes, 1971 : 157.

Description. Lower face 0·55–0·70 times as broad as high; clypeus apically usually with strong lateral protuberances, rarely with these weak; clypeus in profile swollen to excised;

mandibles twisted about 10°, the upper tooth usually about 2·00 times as long as lower; IOD 0·65–1·05 times as long as OOD; posterior ocelli closer to occipital carina than maximum ocellar diameter. Head of ♀ slightly narrowed posteriorly, ♂ from similar to that of ♀ to extremely buccate; vertex punctate; occipital carina medio-dorsally rounded or flattened. Flagellum of moderate length, 52- to 63-segmented; 1st flagellar segment 2·00–2·50 times as long as 2nd; interantennal lamella strong, in profile quadrate. Face with moderately long pale pubescence.

Pronotum punctate, anterior hook strong. Mesoscutum usually punctate; notauli vestigial to distinctly impressed; pubescence of mesoscutum yellowish. Mesopleuron dorsally coriaceous, latero-ventrally punctate; epicnemial carina reaching 0·30–0·50 of way up mesopleuron, usually with upper end indistinct and not reaching anterior pleural margin. Scutellum usually longitudinally concave, rarely with concavity weak, elongate to subquadrate, usually coarsely punctate. Posterior transverse carina of mesosternum complete. Propodeum reticulate, ventrally sculptured; dorsally 0·70–0·95 times as long as broad, without lateral protuberances.

Mid tibial spurs approximately equal in length. Hind leg with basitarsus 0·44–0·54 times as long as tibia, 1·60–2·30 (isolated specimens up to 2·80) times as long as 2nd tarsal segment; 2nd tarsal segment 1·60–2·30 times as long as 3rd; trochanter 0·70–0·90 times as long as trochantellus ventrally; hind tarsal claw geniculate, rarely less strongly curved and with the normally strong basal lobe weaker, 2nd hind tarsal segment of ♂ with strongly impressed ventral area.

Wings infumate weakly; CI = 0·68–1·10; MI = 1·40–2·10; ICI = 0·20–0·90; NI = 0·45–0·65. Forewing length 7–16 mm.

Gaster with tergite 2 2·00–2·30 times as long as tergite 3; ♀ with ovipositor 0·50–0·60 times as long as tergite 2.

♂ genitalia. Distivolsella with spines arranged in apical cluster and with a short row of double spines on ventral margin. Aedeagus in profile apically subequally bilobate; lateral sclerotized region broad, apically dilated, indistinctly delineated.

Head black, lower face, vertical marks and genal orbital marks yellow. Thorax black, tegulae usually reddish, very rarely with tegulae, subalar prominences, and occasionally also scutellum yellowish. Anterior two pairs of legs yellow; hind legs reddish, always with tibia distally and often coxae in part, sometimes also femur dorsally blackish; hind tarsi yellowish.

VARIATION. This species previously was divided into a number of separate species which, together with *H. nigricorne*, were placed in a separate genus, *Schizoloma*. Townes (1971) treated *Schizoloma* as a synonym of *Heteropelma* and Gauld (1976) concurred with this opinion. In the present work all species catalogued by Townes *et al.* (1961; 1965) as *Schizoloma* (except *H. nigritarse*) and one species catalogued as *Heteropelma* (*H. acheron*) are treated as synonyms of *H. amictum*.

This lumping of species is a rather different approach from that currently employed by many Ichneumonologists, who favour a very narrow species concept and frequently make use of the subspecies category (Gupta, 1962; Townes & Chiu, 1970). Because of this contravention of established procedure a detailed discussion of character variation is included.

Townes and co-workers (1961; 1965) have catalogued six species which here are reduced to synonymy. Comparison of the original descriptions and examination of available keys (Morley, 1913*a*; 1913*b*; Schmiedeknecht, 1936; Uchida, 1958) has enabled the author to select those characters which have been used to facilitate specific separation. Study of extensive material has enabled the relative taxonomic merits of these characters to be assessed.

The following characters have been used to facilitate specific separation or show a great deal of variation and therefore may possibly be of use to effect specific separation:

1, gross head shape; 2, structure of clypeo-mandibular region; 3, head colour; 4, antennal colour; 5, microsculpture of vertex; 6, microsculpture of mesonotum; 7, sculpture of propodeum; 8, relative lengths of hind tarsal segments; 9, colour of hind legs; 10, wing venation; 11, scutellar colour; 12, shape of hind tarsal claw; 13, geographical distribution.

These characters are individually discussed below.

1. Gross head shape. Sexual dimorphism in head shape is not uncommon amongst species of the Ichneumonidae and is particularly obvious in some Therionini. This discussion is concerned only with the gross head shape of the males, which typically have the head somewhat more buccate than that of the corresponding females.

Desvignes (1856) described *H. capitatum* from a pair of males which he separated from *H. amictum* by the much more buccate head (Text-figs 12, 13). Although extensive collecting has been undertaken since, no truly intermediate specimens have been discovered. It is therefore quite feasible to regard the two as distinct species as have all previous authors. There are, however, several reasons which have lead the author to believe that *H. capitatum* is conspecific with *H. amictum*. These are as follows.

(a) The females of the species are wholly indistinguishable.

(b) The species are synchronous and sympatric. *H. capitatum* has only been taken occasionally (*ca* 10%) in areas which support a large population of *H. amictum*, such as heathlands (in the Anomaloninae closely related species frequently manifest clear differences in habitat preference. For example *Agrypon anxium* (Wesmael) prefers open hedgerows whilst *A. variitarsum* (Wesmael) is restricted to shaded woodlands).

(c) No consistent differences have been observed in other morphological characters, including genitalia structure.

(d) Although only limited material is available there is apparently no difference in host preference.

(e) The geographical range of the two species almost exactly coincides.

Towards the centre of the range of geographical distribution in the Indo-Malayan region, the incidence of 'buccate headedness' within a population increases. This variation in incidence of buccate headedness of geographically separated populations is tabulated below.

LOCALITY	No. EXAMINED	% BUCCATE HEADED
England: Exmoor	27	10
Nepal: Tapeljung	9	33
Burma: Nam Tami	9	70
Japan: Kamikochi	17	12
Java: Tjibodas region	16	7

(some intermediates were observed in the Japanese population)

Whilst much larger samples must be examined before any reliable inferences can be drawn concerning the variation of incidence of 'buccate headedness' between the populations, it is probably reasonable to suggest that there is a considerable variation in the frequency of 'buccate headedness' between the several populations.

The shape of the ocellar triangle was observed to vary between specimens but this variation was apparently linked to that of the head shape. In specimens with buccate heads the ocellar triangle was approximately equilateral (consequently the anterior angle would be 60°) whilst the specimens without a buccate head were observed to have the ocellar triangle posteriorly broadened (with the anterior angle at or more than 90°).

It may be concluded that gross head shape and shape of the ocellar triangle are not reliable characters for effecting specific separation, as in most populations studied variations of the characters were observed. It is possible that the difference between the simple and buccate headed forms is a single, or relatively few, gene difference as intermediate forms are so uncommon.

In buccate headed specimens there was found to be a much greater development of the adductor muscles of the mandibles. It is possible that having these muscles relatively stronger is a selective advantage in certain areas. As the only apparent function of the Ichneumonid mandibles is to effect escape from the host puparium one might expect that in specimens pupating in large hosts with a strong puparium the possession of exceptionally strong mandibular muscles would be a selective advantage. In other regions where such a host is less common and the principal host is a smaller species with a weaker puparium the possession of a buccate head would not bestow any selective advantage, indeed may even be disadvantageous. Thus one would expect variation in the frequency of buccate headedness between populations.

2. Structure of the clypeo-mandibular region. Morley (1913*a*) separated *acheron* from other species placed in *Schizoloma* on account of the difference in clypeo-mandibular structure. In '*Schizoloma*' the lateral corners of the clypeus are produced until in extreme cases these lateral protuberances entirely conceal the clypeal margin except for a narrow median cleft. In *acheron* and a number of other specimens examined the lateral protuberances were observed to be very weakly developed. Examples of such specimens have been taken in Burma, India, South Korea, Japan and Taiwan. There are three obvious interpretations of the available material.

(a) All represent variants of *H. amictum*.
(b) All are conspecific and represent a distinct species *Heteropelma* X.
(c) All represent distinct species *Heteropelma* B, I, K, J, & T respectively.

To enable further evaluation of the above hypotheses the specimen groups B, I, K, J & T were compared with typical *H. amictum* specimens from neighbouring localities. These data are presented in Table 1.

In each case excluding that of the Japanese specimens, the variants were found to resemble *H. amictum* in all except a single additional feature. The characters tabulated were chosen because they are of use in separating a number of species within this genus. If hypotheses b or c were applicable one would have expected

TABLE 1

A comparison of critical features of variants of *Heteropelma amictum*

VARIANT	CLYPEUS	NUMBER OF FLAGELLAR SEGMENTS	FLAGELLUM COLOUR	MI	CI	RATIO OF 1st TO 2nd HIND TARSI	COLOUR OF HIND COXA	NUMBER OF SPECIMENS EXAMINED
H. amictum (Japan, Kamikochi)	normal	51–57	Red, distally paler proximally darker	1·55–1·80	0·74–0·95	1·60–2·10	Variable black to reddish yellow	18
Heteropelma 'J' (Japan, Hanamaki)	weakly produced	58	as above	1·80–1·90	0·80 0·90	1·60–1·70	Yellow ventrally blackish	2
H. amictum (Korea, Kainai)	normal	55	Reddish yellow	1·60	0·80	1·70	Yellow and badious	1
Heteropelma 'K' (Korea)	moderately produced	50	as above	1·60–1·80	0·80–0·85	1·70–2·20	Reddish yellow and badious	2
H. amictum (India, Simla)	normal	51–58	Red, distally paler proximally darker	1·60–1·75	0·75–0·95	1·70–2·30	Red	8
Heteropelma 'I' (India, Simla)	weakly produced	53–55	as above	1·55–1·75	0·75–0·95	2·10–2·80	Red	6
H. amictum (Burma, Nam Tamai Valley)	normal	54–59	as above	1·45–1·90	0·70–0·95	1·60–2·30	Red	14
Heteropelma 'B' (Burma, Mt Victoria)	very weakly produced	—	as above	1·50–1·70	0·60–0·75	1·80–2·20	Red	4
H. amictum (Taiwan)	normal	52–63	as above	1·60–1·90	0·75–0·85	1·70–2·10	Red	4
Heteropelma 'T' (Taiwan)	weakly produced	50–52	as above	1·70–2·00	0·75–0·85	2·00	Reddish yellow and badious	2

differences in more characters. If b were applicable one would expect more similarity between B, I, K, etc., than these show to *H. amictum*. This is not the case.

Only in the case of 'J' were differences found in more than one additional character. As this group was represented by only a pair of male specimens investigations could not be taken further.

Examination of the available material has shown that reduction of the clypeal protuberance differs in many of the specimens and it is possible to construct a series showing progressive reduction from normal to extremely weakly produced (Burma: Mt Victoria).

As the specimens with the weakly produced clypea were otherwise found to be so similar to typical *H. amictum* specimens and differences where observed were almost always found to be within the range of variation expected for the species as a whole, it is concluded that these specimens represent variants of *H. amictum* (that is accept hypothesis a). The specimens therefore do not warrant separate specific status.

Accompanying the variation in the shape of the clypeus is a variation in the shape of the mandibles. Those of the typical *H. amictum* specimens were observed to be stouter and slightly more twisted than those of the specimens with reduced clypeal protuberances. Variation in clypeal shape amongst the Therionini is invariably accompanied by variation in the mandibular shape. In the present work therefore these are regarded as linked characters so the remarks made concerning the clypeal variation are equally applicable to mandibular variation.

3. Head coloration. Morley (1913*a* : 66) separated *H. amictum* from other species on account of its immaculate vertical orbits. The present author has seen no specimens with immaculate vertical orbits although he has examined Morley's collection. Typically the head was observed to be black with the lower face yellow. Two yellow marks were invariably present on each orbit, one on the vertex and the second just above the centre of the gena. The extent of these marks was observed to vary in the material examined. In some cases the vertical mark was seen to be confluent with the facial area of yellow, but generally the two were discrete.

It must therefore be concluded that the differences in head coloration are of no use for separating *H. amictum* from the 'species' included here as synonyms.

4. Antennal coloration. Cameron (1899) described *fulvicorne* as having the flagellum more evenly fulvous than that of typical *H. amictum*.

Almost all specimens examined were observed to have the antennae reddish, distally yellow, basally externally darker and internally yellowish. In some specimens from the Indo-Malaysian region the yellow areas were less apparent (vide *fulvicorne*). Some Japanese specimens have been observed to have the basal segments of the antennae black. Philippino specimens were observed to have the antennae more or less entirely badious whilst those of Indonesian specimens were entirely black except for one specimen with the extreme distal apex reddish and the base internally yellow marked. Occasional specimens from other regions have similarly marked antennae.

From these observations it may be deduced that antennal coloration may be of some use in separating populations but that the status of these segregates must remain questionable until more characters are examined.

5. Microsculpture of the vertex. Study of species descriptions would lead one to expect that there might be differences between the vertical sculpture of several of the 'species' catalogued as *Schizoloma*.

Most specimens were observed to have the vertex punctate. Some variation in size and density of the puncturation was observed but it was noted that the larger the individual the proportionally more widely separated the punctures were found to be. Consequently more similarity in vertical sculpture was observed between large individuals of geographically widely separated populations, than between large and small specimens of the same population.

Microsculpture of the vertex was not considered to be a useful character to facilitate specific separation.

6. Microsculpture of the mesoscutum (mesonotum of authors). Uchida (1958 : 90) distinguished *H. coreanum* from *H. amictum* by differences in mesoscutal punctuation. The former was described as having the mesoscutum 'ganz matt, dicht fein punktiert' whilst that of the latter was described as 'grösser und zerstreuter als beim *coreanum*'. The author has examined the lectotype of *coreanum* and observed that the puncturation of the mesoscutum is indeed more dense than is usual in *H. amictum*. The puncturation of the mesoscutum of the female paralectotype is far more like that of *H. amictum*. There is no other consistent difference between *coreanum* and *amictum*, and as there is a considerable range of variation of density of puncturation of the mesoscutum within *H. amictum* it is suggested that the puncturation of *H. coreanum* is an extreme variation of the range of that of *H. amictum* and that it is therefore justifiable to include this species as a synonym of *H. amictum*.

7. Sculpture of the propodeum. Differences in propodeal sculpture have been used by Morley (1913*a* : 66; 1915 : 226) and Uchida (1958 : 90) to separate *H. capitatum* from *H. amictum*. That of the former is described as 'radiating from the centre' whilst that of the latter is said to 'form areae'.

A very large range of variation in the complex sculpture patterns of the propodea of *Heteropelma* species have been observed. Large specimens invariably tend to have extremely coarse reticulations with far more enclosed areae. Propodeal sculpture is therefore not considered to be useful in classifying species of *Heteropelma*.

8. Relative length of the hind tarsal segments. Reference to relative length of the 1st and 2nd hind tarsal segments in species descriptions are generally inaccurate approximations. Thus it appears that there may be differences in the ratios of tarsal lengths between the various described entities considered here.

No differences were observed between males and females (other than the broadening of the male tarsi which in a superficial examination may give the impression that the tarsi are proportionally shorter than those of the female). All specimens examined were found to have the hind basitarsus between 1·60 and 2·80 times as long as the second tarsal segment with a mean of 1·92.

9. Colour of hind legs. Typically the legs are yellowish red with the coxae and trochanteral segments paler ventrally, coxae proximally and distal 0·3 of tibiae

blackish. The tarsi are immaculately yellow. This colour pattern is fairly constant throughout the European and Indo-Malayan ranges of distribution, with the latter sometimes having the proximal segments less clearly pale marked ventrally.

The coxal colour was observed to be more variable. One group of specimens from Nepal showed a range of colour variation. Some specimens had the coxae red with the extreme proximal margins black, other specimens were intermediate and some extreme specimens were observed to have the coxae entirely black. Similar variation has been observed in Japanese species.

In some specimens the coxae were observed to be very dark except for the ventral area which was yellow marked. Such specimens were usually, but not always, observed to have the femora badious dorsally. This colour pattern was most common in specimens from Java, Sumatra and the Philippines, although isolated specimens from other regions also exhibit a similar colour pattern.

A single specimen from Sulawesi was observed not to have the hind tibia dark marked distally.

From these observations one may conclude that coloration of the hind legs alone is not a suitable character for specific separation, but that this colour patterning may be of use in segregating groups of specimens from different regions.

10. Wing venation. Morley (1913*a* : 66; 1913*b* : 403; 1915 : 226) used features of wing venation to facilitate species separation. In the two earlier works he used the position of the internal cubital (i.e. 1*m–cu*) with respect to its point of contact with $2 + 3rm/M$. In this work this position is quantified by the inter-cubital

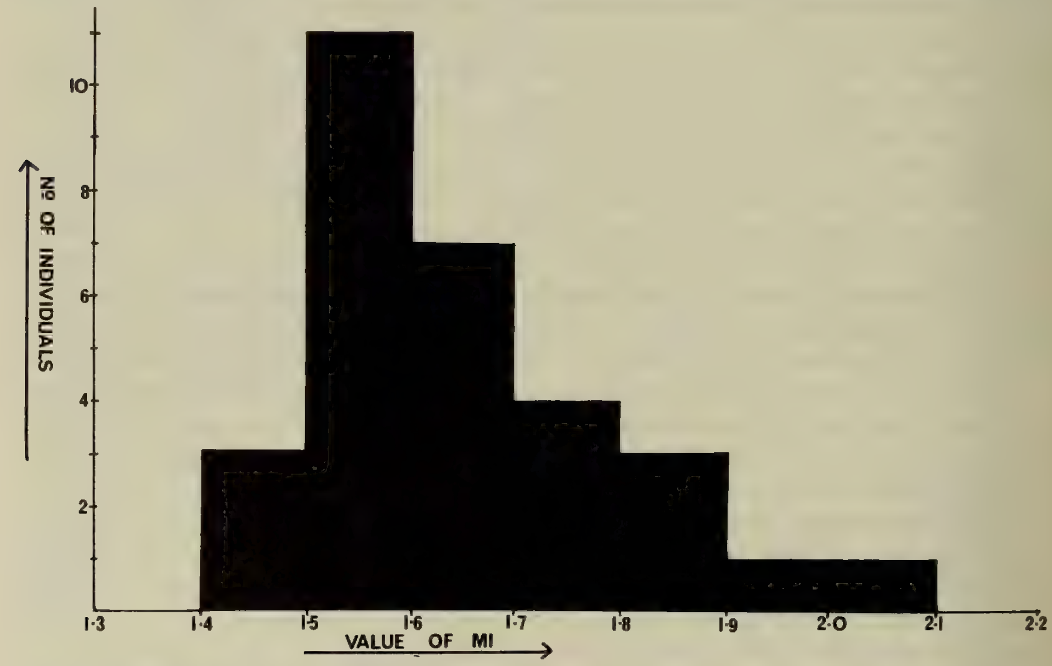


CHART 1. Histogram showing the range of values of MI in *Heteropelma amictum*. [Class width = 0·1; sample number 15 ♀, 15 ♂].

index ICI. In the latter work Morley used the shape of the radial cell to distinguish two species. This shape is quantified by the marginal index MI.

Values of the marginal index are shown in Chart 1. These values were obtained from the measurement of thirty specimens (15 ♀, 15 ♂) from the Palaearctic/Indo-Malayan regions. Of the specimens measured 7 ♂ were clearly referable to *capitatum* whilst 8 were typical *amictum*. It can be seen from the chart that there is no indication of a bimodal distribution of values. Such a bimodal distribution would be expected if two species differing in values of MI had been confused. It may be assumed therefore that the value of MI is not a reliable character for the separation of species.

The cubital cross vein region of the forewing of Anomaloninae is an area of morphological 'instability' (i.e. one often encounters considerable intraspecific variation in this region, see Gauld (1976)). Measurement of the ICI was undertaken for a number of typical specimens of *H. amictum* and for a number of buccate headed specimens. The results are given below.

	No. MEASURED	RANGE OF ICI	MEAN
typical *H. amictum*	15	0·2–0·8	0·55
buccate headed specimens	15	0·3–0·9	0·60

It may be deduced that there is no significant difference between the values of ICI. This character is therefore of no use in facilitating specific separation.

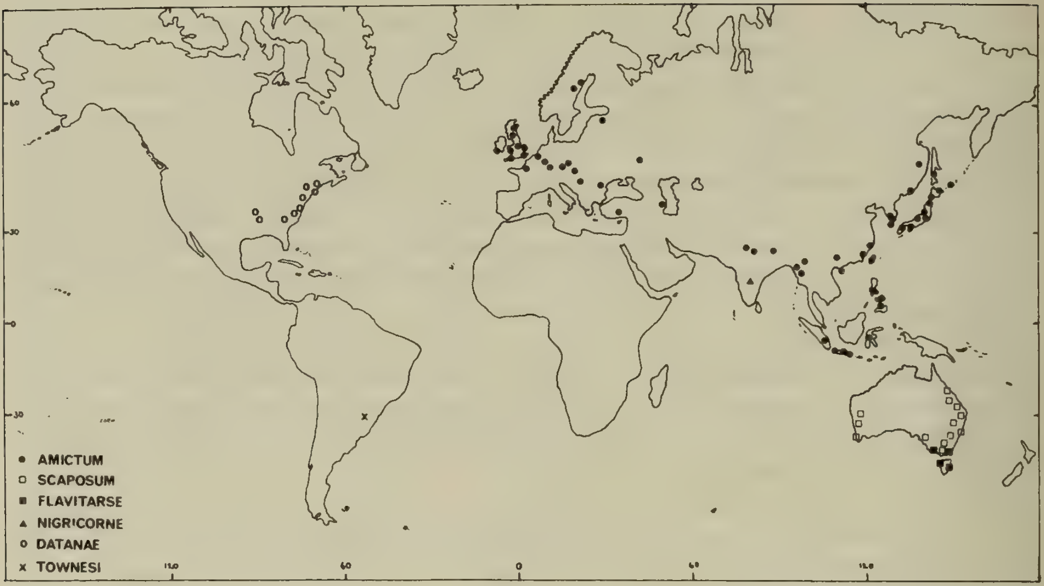
11. Colour of scutellum. Isolated specimens have been found to have the scutellum yellow. No other consistent morphological differences were observed between these specimens and typical specimens of *H. amictum*.

12. Shape of hind tarsal claws. In *H. amictum* as in most other species of *Heteropelma* the hind tarsal claws are typically geniculate and basally lobate. In the south-east of the range of distribution some specimens have been observed to have modified claws, that is with the basal lobe reduced. The Javan population was found to have a high incidence of this modification. Of the 18 specimens examined only 4 were found to have normally lobate claws.

However, because there is variation in this character it is alone not suitable for facilitating specific separation.

13. Geographical distribution. From the material available it has been established that this species extends from Britain throughout the Palaearctic region to Japan, along the Himalayas into southern China, Taiwan and the Philippines and also in Burma, Sumatra, Java and Sulawesi (Map 2).

Ichneumonidae have not been extensively collected and in the past authors tended to regard specimens collected by expeditions to relatively unworked areas as new. Such specimens are described as species novae and the description serves to distinguish them from the better known (usually Palaearctic) species of the genus. Such is the case in question. Numerous species of '*Schizoloma*' have been described from very little material and generally each differs slightly from other described entities. The problem presented here is whether or not these entities deserve specific status. Examination of fairly extensive material from the above



Map 2. The world (Mercator projection) showing distributions of *Heteropelma amictum*, *H. scaposum*, *H. flavitarse*, *H. nigricorne*, *H. datanae* and *H. townesi*.

mentioned countries has indicated that there is a large range of variation in several 'critical' characters even within a population and that the extent of this variation broadly overlaps that of populations in neighbouring countries. When considering the range of distribution as a whole, widely separated populations were found to exhibit quite different frequencies of the various character conditions. Such differences within a species of broad geographical distribution are to be expected and such clinal variation has been fully discussed by a number of authors (Huxley, 1939; Crowson, 1970).

No standard way of designating such clinal variation has been adopted. Huxley (1939) suggested the naming of only the end forms and using formulae to indicate various intermediates. This method has not been adopted by subsequent workers nor is it covered by the current *International Code of Zoological Nomenclature*. Additional complications are introduced in the present case as the eastern end of the distribution of *H. amictum* is apparently bifurcate.

Using the variations of clinal gradient to delimit natural subspecies (as suggested by Crowson, 1970) is not possible in the present case as insufficient material is available for study.

The present author's approach to the outlined clinal variation is to refrain from designating any population as a subspecies of *H. amictum*.

The status of one population deserves further consideration. A group of 18 specimens from Java were observed to be rather distinct from the remainder of the species. The Javanese specimens were found to have a low percentage incidence of buccate headedness, to generally have the flagellum black, to have the hind femora black marked and to have a high incidence of weakly lobate hind tarsal claws. If clinal gradient may be expressed as a formula of the form, number of character conditions found in 80% of the population A and observed in less than 20% of population B, divided by the linear distance separating the two populations plotted against the linear distance separating the two populations, then the gradient between the Burmese population and the Javan population would be greater than that between the former, and either the European or Japanese populations. This would seem to indicate that the Javan population may deserve separate subspecific status. However, no specimens from the intermediate areas of the Malay peninsula are available for study and only a single specimen from Sumatra was seen. This Sumatran specimen, whilst having many features of the Java population, was observed to have geniculate claws and a buccate head. For the present, therefore, the Javan population is included within *H. amictum* and not accorded subspecific status.

A similar approach was adopted by Perkins (1953) in his work on the British Ichneumoninae. Although he mentions (p. 117) that there are minor differences between the British examples of a species and conspecific European specimens he did not elevate the British population to separate subspecific status.

Unfortunately in this work it has only been possible to study the morphology of the adult insect extensively. Such an approach is not wholly adequate when investigating such complex clinal variation. From consideration of the data presented above it has been suggested that all specimens are better retained within a single species, *H. amictum*. It is not inconceivable that there may be marked differences in the habitat preference, host selection, behavioural patterns and larval structure between some of the populations. Such data, if and when they become available, may be found to correlate with geographical and character state frequency differences mentioned above. In such a case it may be necessary to reconsider the classification herein proposed.

HOST RECORDS. This species has been recorded as a parasite of the following lepidopterous larvae: *Bena prasinana* (L.) (Meyer, 1935; Schmiedeknecht, 1935); *Callimorpha dominula* (L.) (Meyer, 1935; Schmiedeknecht, 1935); *Dasychira pudibunda* (L.) (Uchida, 1928; 1958; Meyer, 1935; Schmiedeknecht, 1935); *Dendrolimus albolineatus* Matsumura (Matsumura, 1926; Uchida, 1928); *D. sibiricus* Tschetverikov (Matsumura, 1926); *D. spectabilis* (Butler) and *D. superans* (Butler) (Uchida, 1958); *Eupithecia linariata* (Denis & Schiffermüller) (Meyer, 1935; Schmiedeknecht, 1935); *Hyloicus pinastri* (L.) (Meyer, 1935); *Lacanobia oleracea* (L.) (Morley, 1915); *Lathoe populi* (L.) (Meyer, 1935; Schmiedeknecht, 1935); *Lithophane ornitopus* (Hufnagel) (Meyer, 1935; Schmiedeknecht, 1935); *Macrothylacia rubi* (L.) (Meyer, 1935; Schmiedeknecht, 1935); *Phalera bucephala* (L.) (Meyer, 1935; Schmiedeknecht, 1935); *Polia nebulosa* (Hufnagel) (Morley, 1915); *Thaumatopoea processionea* (L.) (Meyer, 1935; Schmiedeknecht, 1935).

DISTRIBUTION (Map 2). This species has been recorded from most northern European countries (Morley, 1915; Schmiedeknecht, 1935) but is possibly absent from the Mediterranean basin as Ceballos (1963) failed to record it from Spain.

It has been recorded from Japan, Korea, Kuriles, Sakhalin and Formosa (Uchida, 1928; 1958), and widely from the U.S.S.R. (Meyer, 1935). In the Oriental region it has been recorded from India and Burma (Morley, 1913*b*) and from Sumatra (Enderlein, 1921).

MATERIAL EXAMINED.

Ichneumon amictum Fabricius, holotype ♀, no further data (BMNH). *Anomalon capitatum* Desvignes, lectotype ♂, GREAT BRITAIN: England, no further data (BMNH); (depository of paralectotypes unknown). *Anomalon tinctipenne* Cameron, lectotype ♀, INDIA: Assam, Khasia Hills (UM); paralectotypes 3 ♀, 1 ♂, same locality as lectotype (BMNH); 4 ♀, 1 ♂, same locality as lectotype (UM). *Schizoloma fulvicorne* Cameron, lectotype ♂, INDIA, no further data (UM); 1 ♂, ? paralectotype, no data (UM). *Exochilum acheron* Morley, lectotype ♀, INDIA: 1851 (*Baly*) (BMNH); paralectotypes 2 ♀, 3 ♂, INDIA: 1851 (BMNH) [Townes *et al.* (1961) state that the type depository of *acheron* is the UM (Oxford). The author has examined the collections in the UM and has seen no specimen that could have indisputably been before Morley when he described this species. However, there are in the BMNH 3 ♀, 3 ♂ labelled in 1910 by Morley as *Exochilum acheron* and from the appended locality data it was clearly apparent that these specimens were syntypes. An intact female was therefore selected as lectotype.] *Schizoloma crassicalx* Enderlein, holotype ♂, SUMATRA: no further data (IZPAN). *Schizoloma coreanum* Uchida, lectotype ♂, KOREA: no further data (EIHU).

BELGIUM: 1 ♀, no further data (BMNH); 1 ♀, 1 ♂, no further data (IRSNB). BURMA: 2 ♀, 2 ♂, Mt Victoria xii–iv. 1937–38 (*Heinrich*) (HKT); 1 ♀, 1 ♂, Nam Tamai, xi. 1931 (*Cranbrook*) (BMNH); 4 ♀, 8 ♂, Nam Tamai Valley, viii–ix. 1938 (*Kaulback*) (BMNH); 1 ♀, 1 ♂, Nam Tisong, i. 1931 (*Ward*) (BMNH). CHINA: 2 ♀, 2 ♂, Fukien, Shaowu Hsien, vi–x. 1943–45 (*Maa*) (HKT); 1 ♂, Kiangsi, Hong San, vii. 1936 (HKT); 2 ♂, Szechwan, Kwan, viii. 1938 (HKT). GERMANY: 1 ♀, Berlin, no further data (BMNH); 2 ♀, 2 ♂, no data (BMNH); 1 ♀, no data (IRSNB). GREAT BRITAIN: 1 ♀, Cheshire, Delamere Forest, 1904 (BMNH); 1 ♀, 1 ♂, Cumbria, Witherslack, vii. 1922, ex *Polia nebulosa* (Hufnagel) (*Lowther*) (BMNH); 20 ♀, 27 ♂, Devon, Exmoor, viii. 1971 (*Gauld*) (BMNH); 7 ♀, 5 ♂, Devon, no further data (BMNH); 2 ♀, 5 ♂, Grampian 'Aberdeenshire', Glen Muick, vii. 1975 (*Gauld*) (BMNH); 1 ♀, 1 ♂, Highland 'Inverness-shire', Aviemore, vii. 1929 (*Harwood*) (BMNH); 1 ♂ no locality data, ex *Cucullia* sp. (*Bond*) (BMNH); 7 ♀, 5 ♂, no data (BMNH). INDIA: 4 ♀, 6 ♂, 'Northern India', no further data (UM); 1 ♀, 1 ♂, Simla, viii. 1918 (*Brunetti*) (BMNH); 1 ♂, no data (BMNH). IRELAND: 1 ♂, Eire, Bantry, viii. 1909 (*Fletcher*) (BMNH). JAPAN: 2 ♂, Hanamaki, Iwate, vi. 1953 (*Sato*) (HKT); 1 ♀, 17 ♂, Kamikochi, vii. 1954 (*Townes family*) (HKT); 2 ♀, 1 ♂, Mt Norikura, vii. 1954 (*Townes family*) (HKT); 1 ♂, Mt Wakasugi, ii. 1927 (*Yasamatsu*) (HKT); 3 ♀, Sapporo, vii. 1954 (*Townes family*) (HKT); 1 ♀, Yamanischi, vi. 1927 (HKT); 1 ♂, no data (*Matsumura*) (HKT). JAVA: 1 ♀, 1 ♂, Dgampang Mts, ix. 1938 (*Bengbreng*) (BMNH); 1 ♂, Digeenoeng, Dgampang Tengah, 1939+ (HKT); 1 ♂, Gunung, Gedeh, viii. 1937 (*Sloe*) (BMNH); 1 ♀, Mt Gede, i. 1935 (HKT); 1 ♂, Nougkodyadjar, v. 1938 (*Walsh*) (BMNH); 3 ♀, 4 ♂, Tjibodas, Gedeh, 1930–7 (*Leftinck*) (HKT); 2 ♂, Tjibodas,

viii. 1934 (*Handschin*) (BMNH); 1 ♀, 1 ♂, Tjibodas, iii. 1916 (*Robinson*) (BMNH); 1 ♀, no further data (IRSNB). Korea: 1 ♂, vii. 1931 (*Sato*) (HKT). Nepal: 1 ♀, 9 ♂, Taplejung, between Sangu and Tamrang, x–xi. 1961 (*Coe*) (BMNH). Philippines: 1 ♂, Abra, Basiwa, iii. 1953 (*M. C. Townes*) (HKT); 3 ♂, Kalinga, Babalasang, iii. 1953 (*M. C. Townes*) (HKT). Sulawesi: 1 ♀, Todjambol, vii. 1936 (*Toxopeus*) (HKT). Sweden: 1 ♀, 1 ♂, Kivik, vii. 1938 (*D. M. S. & J. F. Perkins*) (BMNH). Taiwan: 1 ♀, Arisan, vi. 1931 (*Gressitt*) (HKT); 1 ♂, Kuraru, vi. 1934 (*Gressitt*) (HKT); 1 ♂ Matsumine, v. 1932 (*Gressitt*) (HKT); 1 ♂, Sakashen, vii. 1934 (*Gressitt*) (HKT). U.S.S.R.: 4 ♀, 3 ♂, Kiev, no further data (IRSNB); 1 ♂, Vladivostok (*Tosquinet*) (IRSNB).

RELATIONSHIPS BETWEEN THE SPECIES

It is not within the scope of a work such as this to discuss the relative merits and shortcomings of phenetic versus phylogenetic classification. It is the opinion of the author that both approaches may be of some use in expanding our knowledge of various groups. In this work therefore phenetic and phylogenetic classifications of the species of *Heteropelma* are discussed separately below.

Phenetic interrelationships. From the species under consideration a large number of characters were considered and those showing little or no inter-specific variation were eliminated. The remaining forty characters were considered to be representative of the interspecific variation. These characters were formulated so as to allow an insect to be scored as either + or —. This system of scoring is not meant to infer that a + character is in any way more significant than a — one. In a few cases intermediates have been found and these were scored ± and were not considered to differ from a + or a — character. In a very few cases full information was not available because of lack of material of one or other sex. In these cases percentage similarities were calculated for the number of scored characters compared.

The characters used together with their + and — alternatives are listed below.

CHARACTER	+	—
1. Clypeal shape	flat	laterally swollen
2. IOD in relation to OOD	greater than	equal to or less than
3. No. of flagellar segments	49 or less	50 or more
4. Gross head shape	constricted	not constricted
5. Occipital carina dorsally	concave	flat or convex
6. Yellow vertical marks	present	absent
7. Interantennal lamella	quadrate	not quadrate
8. Facial pubescence	white or yellow	black or reddish
9. Female facial colour	entirely yellow	not entirely yellow
10. Width of lower face compared with height	0·79 or less	0·80 or more
11. Pronotal hook	strong	vestigial
12. Notauli	present	absent
13. Mesoscutum centrally	coriaceous	punctate

CHARACTER	+	−
14. Height of epicnemial carina in relation to 0·4 of height of mesopleuron	at or above	below
15. Upper end of epicnemial carina	reaching anterior pleural margin	not reaching anterior pleural margin
16. Sculpture of latero-ventral part of mesopleuron	coarsely punctate	finely punctate
17. Sternaulus	strong	weak
18. Scutellum in profile	flat	humped
19. Posterior transverse carina mesosternum	complete	incomplete centrally
20. Propodeal projections	present	absent
21. Propodeum ventrally	smooth	sculptured
22. Propodeum dorsally	0·9– as long as broad	0·91+ as long as broad
23. Colour of thorax	black	not black
24. Colour of scutellum compared with mesoscutum	contrasted	concolorous
25. Mid tibial spurs	subequal	inequal or one absent
26. Hind basitarsal length	3·00+ times length of tarsus 2	2·99– times length of of tarsus 2
27. Hind trochanter length	0·91+ times length of trochantellum	0·90– times length of trochantellus
28. Shape of hind tarsal claw distally	geniculate	simply curved
29. Shape of hind tarsal claw basally	strongly lobate	weakly lobate
30. Impressed area on male hind tarsus 2	present	absent
31. Colour of hind basitarsus	entirely yellow	not entirely yellow
32. Wing colour	black	not black
33. CI	0·80–	0·81+
34. MI	2·00–	2·01+
35. NI	0·50–	0·51+
36. ICI	0·30–	0·31+
37. Tergite 2 length compared with that of tergite 3	2·00+	1·99–
38. Tergite 3 length compared with that of tergite 4	0·80–	0·81+
39. Aedeagal apex	subequally bilobate	not equally bilobate
40. Occipital carina dorsally	complete	incomplete

By comparison of the various species scored percentage similarities were calculated and these values were tabulated in the form of a similarity matrix (Table 2). From these results an average linkage dendrogram was produced (Chart 2) using the unweighted paired group method (UPGMA) of analysis. Thus

$$S_{(abc),\,d} = \tfrac{1}{3}\,(S_{a,\,d} + S_{b,\,d} + S_{c,\,d})$$

where S = similarity and a, b, c, & d represents species.

It can be seen from the dendrogram that *H. celeno* and *H. aello* have comparatively few characters in common with the remainder of the genus. In the 74–76%

similarity range the greater part of the genus divides into two species-groups, the *H. calcator* and *H. amictum* species-groups. Several species separate singly (*H. flavitarse, H. savaiiense, H. datanae* and *H. townesi*).

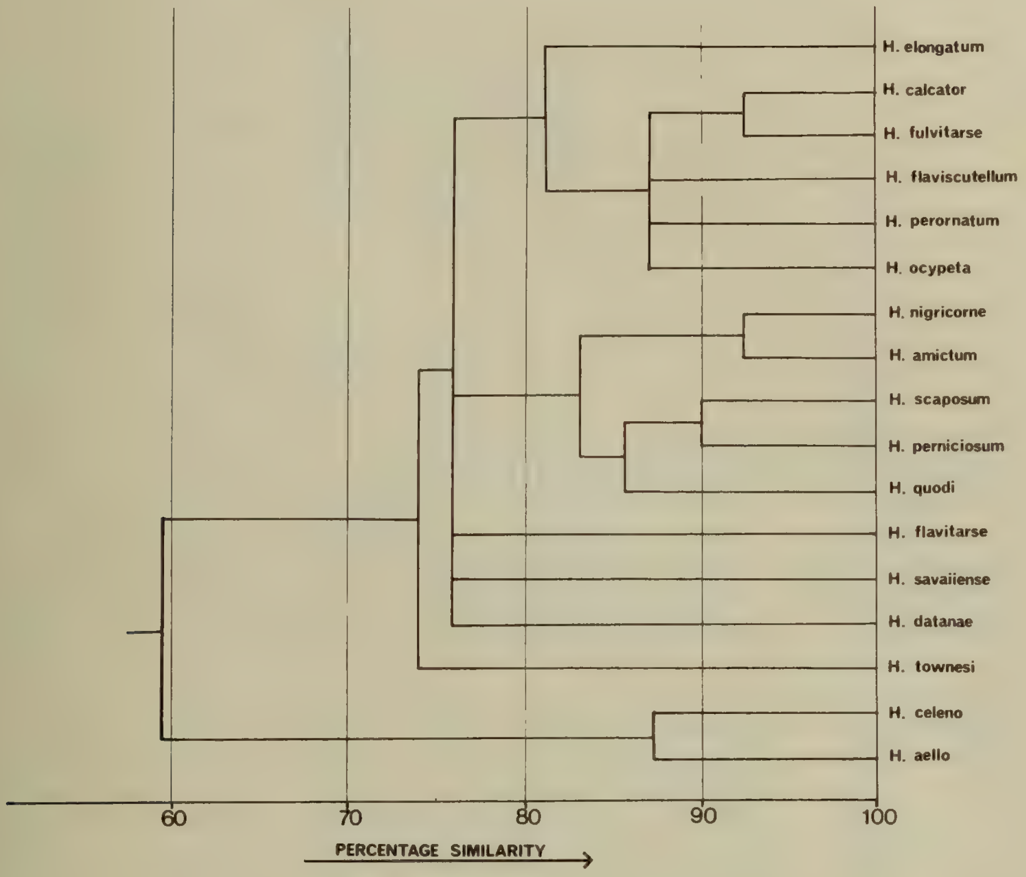

H. elongatum
H. calcator
H. fulvitarse
H. flaviscutellum
H. perornatum
H. ocypeta
H. nigricorne
H. amictum
H. scaposum
H. perniciosum
H. quodi
H. flavitarse
H. savaiiense
H. datanae
H. townesi
H. celeno
H. aello
60
70
80
90
100
PERCENTAGE SIMILARITY

CHART 2. Dendrogram showing phenetic interrelationships of species of *Heteropelma*.

PROPOSED PHYLOGENETIC INTERRELATIONSHIPS. In any attempt to elucidate the phylogeny of a group (in the absence of a fossil record) the principal source of error is the separation of ancestral characters from derived ones. For example, in *Heteropelma* the absence of an inter-antennal lamella could either be regarded as an ancestral condition (by assuming that a particular species diverged from the main stock prior to the development of this lamella) or a derived condition (by assuming that the absence of lamella is the result of secondary reduction of the feature).

TABLE 2

Percentage similarity matrix. (Figures taken to nearest 0·5%)

	elongatum	*calcator*	*fulvitarse*	*flaviscutellum*	*perornatum*	*ocypeta*	*nigricorne*	*amictum*	*scaposum*	*perniciosum*	*quodi*	*flavitarse*	*savaiiense*	*datanae*	*townesi*	*celeno*
calcator	80·0															
fulvitarse	87·5	95·2														
flaviscutellum	75·0	75·0	77·5													
perornatum	85·0	82·0	87·0	85·5												
ocypeta	77·0	84·0	90·0	87·0	87·0											
nigricorne	75·0	77·0	75·0	67·0	75·0	64·0										
amictum	85·0	85·0	85·0	75·5	85·5	69·0	92·5									
scaposum	77·5	85·0	82·5	77·5	82·5	74·0	87·0	87·0								
perniciosum	66·0	87·0	82·0	69·0	77·0	72·0	77·0	82·0	90·0							
quodi	67·0	70·0	72·5	65·0	77·5	67·0	83·0	85·0	87·0	84·0						
flavitarse	62·5	65·0	67·0	55·0	65·0	59·0	70·0	82·5	80·0	75·0	75·0					
savaiiense	72·0	74·0	79·0	72·0	82·0	76·0	62·5	72·5	74·0	68·0	64·0	64·0				
datanae	77·5	65·0	67·5	70·0	70·0	62·0	82·5	75·0	75·0	64·0	80·0	62·5	62·5			
townesi	72·0	67·0	75·0	72·0	72·0	74·0	65·0	75·0	75·0	67·0	70·0	50·0	60·0	62·5		
celeno	60·0	55·0	62·0	47·5	65·0	49·0	60·0	69·0	60·0	62·0	67·0	70·0	59·0	52·5	52·5	
aello	60·0	52·5	62·5	52·5	60·0	56·0	55·0	62·5	62·5	62·0	68·0	70·0	62·0	52·5	52·5	87·5

Consideration of the genus as a whole and its relationship to other genera has enabled the author to tentatively suggest that within *Heteropelma* the following may be considered to be ancestral character conditions.

1, flat clypeus without lateral projections;
2, absence of a pronotal hook;
3, presence of strongly impressed notauli;
4, possession of a complete mesosternal transcarina;
5, absence of lateral propodeal protuberances;
6, presence of a pair of subequal mid tibial spurs;
7, having the hind basitarsus less than 2·90 times as long as tarsus 2;
8, having the hind tarsal claws simply curved;
9. having the hind tarsal claws basally weakly lobate;
10, lacking an impressed area on the male tarsi;
11, having CI greater than 0·81;
12, having MI less than 2·00;
13, having the aedeagus terminally unequally bilobate;
14, having the occipital carina complete.

All these character conditions are found to occur frequently amongst the more primitive Therionini, that is amongst genera in which the cephalic capsule of the final instar larvae have discernible traces of hypostomal spurs. In the majority of Therionini the hypostomal spurs are entirely lost.

Using the method adopted by Gupta (1962) the index of divergence (i.e. number of derived characters) was calculated for each species of *Heteropelma* (Table 3). The position of the species was then shown in Chart 3 and the proposed phylogenies indicated by lines.

It is suggested that four species-groups exist. The largest of these, the *calcator*-group contains six species, *H. calcator*, *H. fulvitarse*, *H. elongatum*, *H. flaviscutellum*, *H. perornatum* and *H. ocypeta*. *H. townesi* is also believed to have been derived from this group, but because it is so widely geographically separated from the other species it has diverged morphologically and evolved a number of character conditions not found in other species (unicalcarate mid tibiae, high value of MI). All species in this group may be characterized by the possession of elongate hind basitarsi, simple clypeal structure, having the head weakly sexually dimorphic, etc. Within the group there are several very distinct specializations. *H. ocypeta* and *H. perornatum* show a tendency to develop strongly constricted heads. *H. elongatum* and *H. flaviscutellum* have apparently lost the impressed area on the male hind tarsi. (The reason for assuming these species have lost the impressed tarsal area whilst later assuming that *H. datanae* may either not have had or have lost a very long time ago such an impressed area are twofold. Firstly, some males of *H. fulvitarse*, which is morphologically very similar to *H. elongatum* and *H. flaviscutellum*, have a reduced tarsal impression, intermediate in form between those of *H. calcator* and *H. elongatum*. Secondly, the impressed area typically bears numerous flattened microtrichia which are often also present on ventro-distal

Table 3

Indices of divergence

SPECIES	CHARACTER CONDITION 1	2	3	4	5	6	7	8	9	10	11	12	13	14	INDEX OF DIVERGENCE
elongatum	0	1	0	0	0	0	1	1	1	0	1	0	1	0	6·0
calcator	0	1	0	0	0	0	1	1	1	1	1	0	1	0	7·0
fulvitarse	0	1	0	0	0	0	1	1	1	1	0·5	0	1	0	6·5
flaviscutellum	0	0	0	0	0	1	1	1	1	0	0	0	1	0	5·0
perornatum	0	1	0	0	0	0	1	1	1	1	0·5	0	1	0	6·5
ocypeta	0	1	0	0	0	1	1	1	1	1?	0	0	1?	0	7·0
nigricorne	1	1	0	0	0	0	1	1	1	1	0·5	0	1	0	7·5
amictum	1	1	0	0	0	0	0	0·5	0·5	1	1	0	1	0	6·0
scaposum	0	1	0	0	0	0	0	1	1	1	0·5	0	0	0	4·5
perniciosum	0	1	0	0	0	0	0	1	1	1?	0	0	0?	0	4·0
quodi	0	1	0	0	0	0	0	1	1	1	0	0	1	0	5·0
flavitarse	0	1	0	0	0	0	0	0	1	1	0	0	0	0	3·0
savaiiense	0	0	0	0	0	0	0	1	1	1	0	0	1	0	4·0
datanae	0	1	0	0	0	0	0	1	1	0	0	0	1	0	4·0
townesi	0	1	0	0	0	1	0·5	1	1	1	1	1	0	1	8·5
celeno	0	0	1	0	1	0	0	0	0	1	1	0	0	0	4·0
aello	0	0	1	1	1	0	0	0	0	1	0	0	1	0	5·0

(O = ancestral character condition; 1 = advanced condition; 0·5 signifies an intermediate character condition)

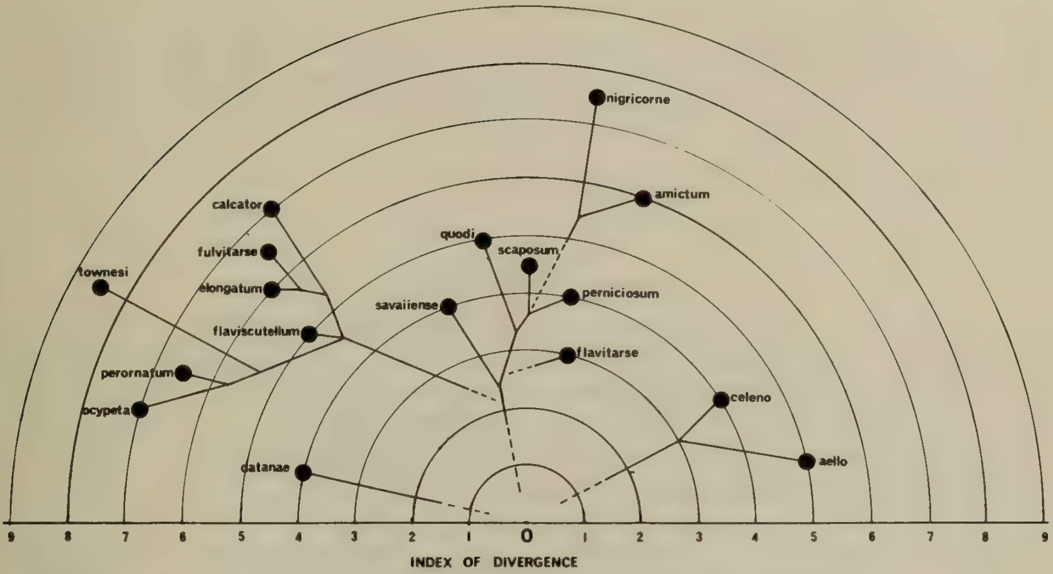


CHART 3. Proposed phylogenetic interrelationships of species of *Heteropelma*.

apex of the basitarsus. Flattened microtrichia are found on the tarsi of *H. elongatum* and *H. flaviscutellum* but have not been observed on the tarsi of *H. datanae*.)

The second and third species-groups are believed to be more closely interrelated than are either to the previously mentioned species-group. One of these, the *amictum*-group, contains only a pair of species characterized by the obviously swollen clypeus, relatively short basitarsus, etc. The second of these two groups, the *scaposum*-group, contains entirely Australasian species, *H. scaposum*, *H. perniciosum*, *H. quodi*, *H. savaiiense* and *H. flavitarse*. All these species except *H. savaiiense* have a bicoloured hind basitarsus. The group as a whole may be characterized by short basitarsus, simple clypeus, etc. Occasional specimens in this species-group have been observed to have a faint trace of lateral clypeal swellings. This and the similarity in form of the hind legs has been interpreted as indicative of a close phylogenetic relationship between this and the *amictum*-group.

A fourth species-group contains the two Papuan species, *H. celeno* and *H. aello*. These are distinct from all other species in a large number of features including propodeal shape, form of tarsal claws, absence of pronotal hook, etc. The affinities of these species are not clear but they do not appear to be at all closely related to the other Australasian species which all belong in the *scaposum*-group. Certain features of the *celeno*-group seem to indicate that it diverged from the main stock of the genus a considerable time ago. The structure of the aedeagus, form of the posterior transcarina of the mesosternum, and shape and coloration of the female face are reminiscent of those of *Therion* species. These two species may possibly be rather specialized descendants of species which diverged from the main *Heteropelma* stock shortly after *Heteropelma* and *Therion* separated. Far more evidence is needed, however, before any reliable statements can be made concerning the position of this species-group. It would be of particular interest to examine the first instar larva of these species as considerable differences are known to exist between the first instar larvae of *Therion* and *Heteropelma* (Plotnikov, 1914; Tothill, 1922).

The position of *H. datanae* is unclear at present.

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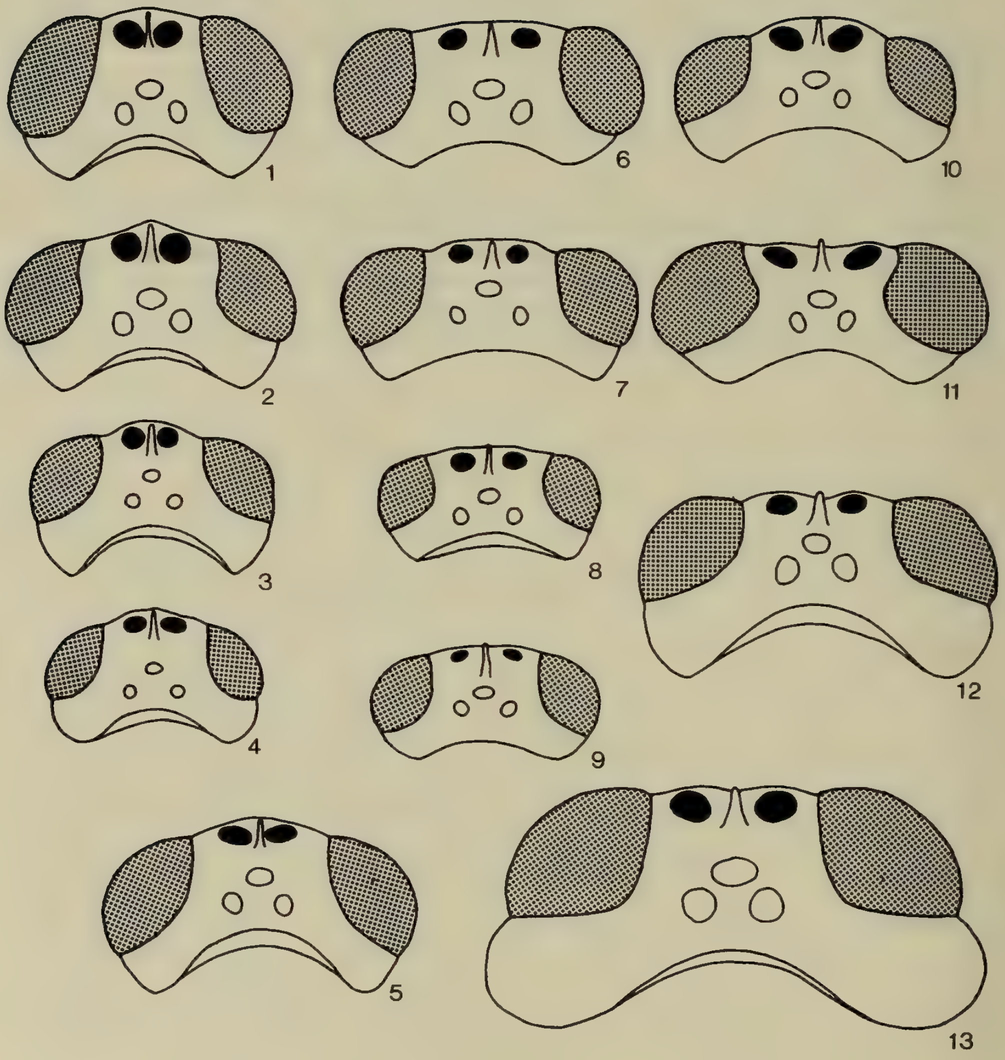

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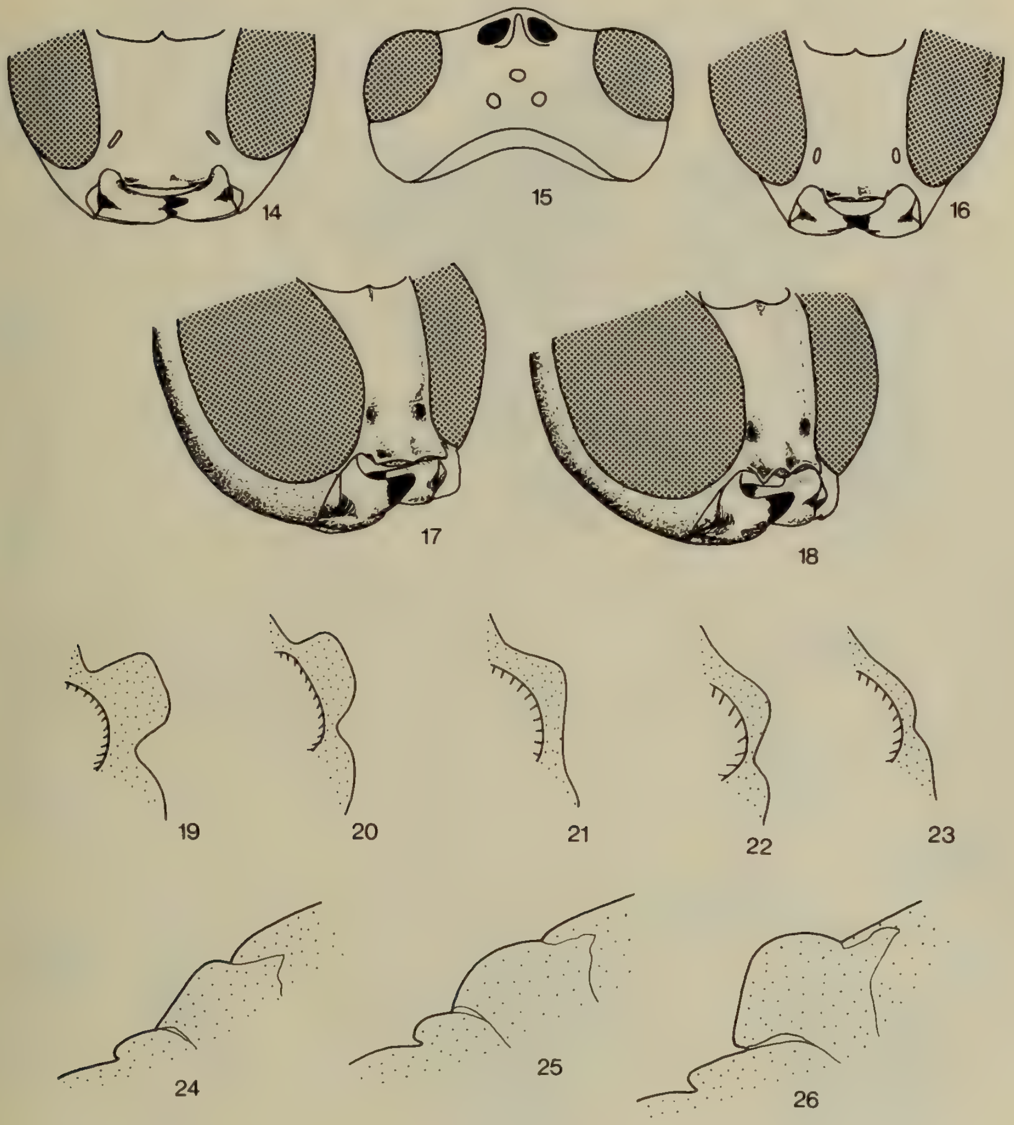

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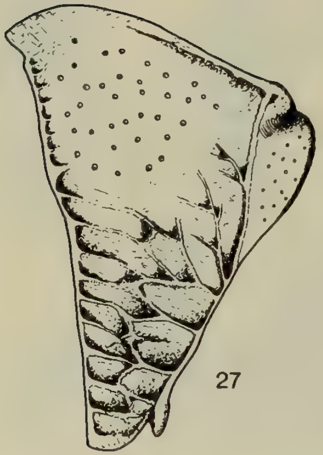

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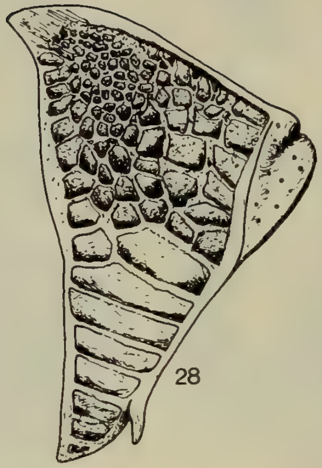

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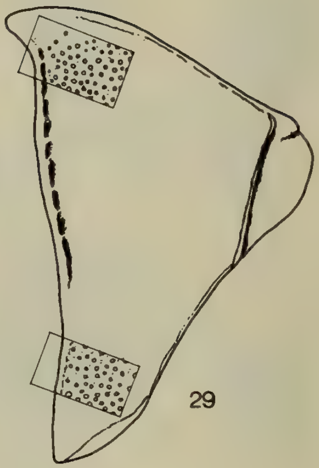

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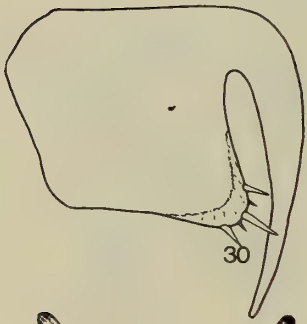

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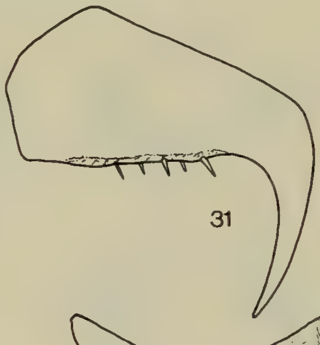

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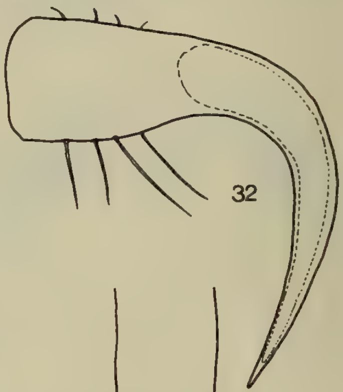

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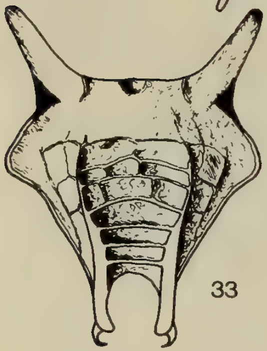

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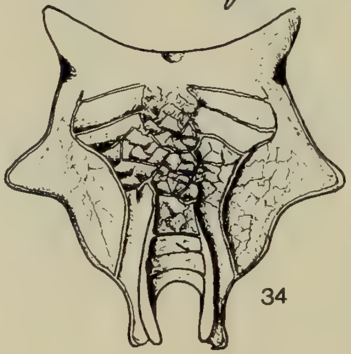

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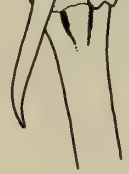

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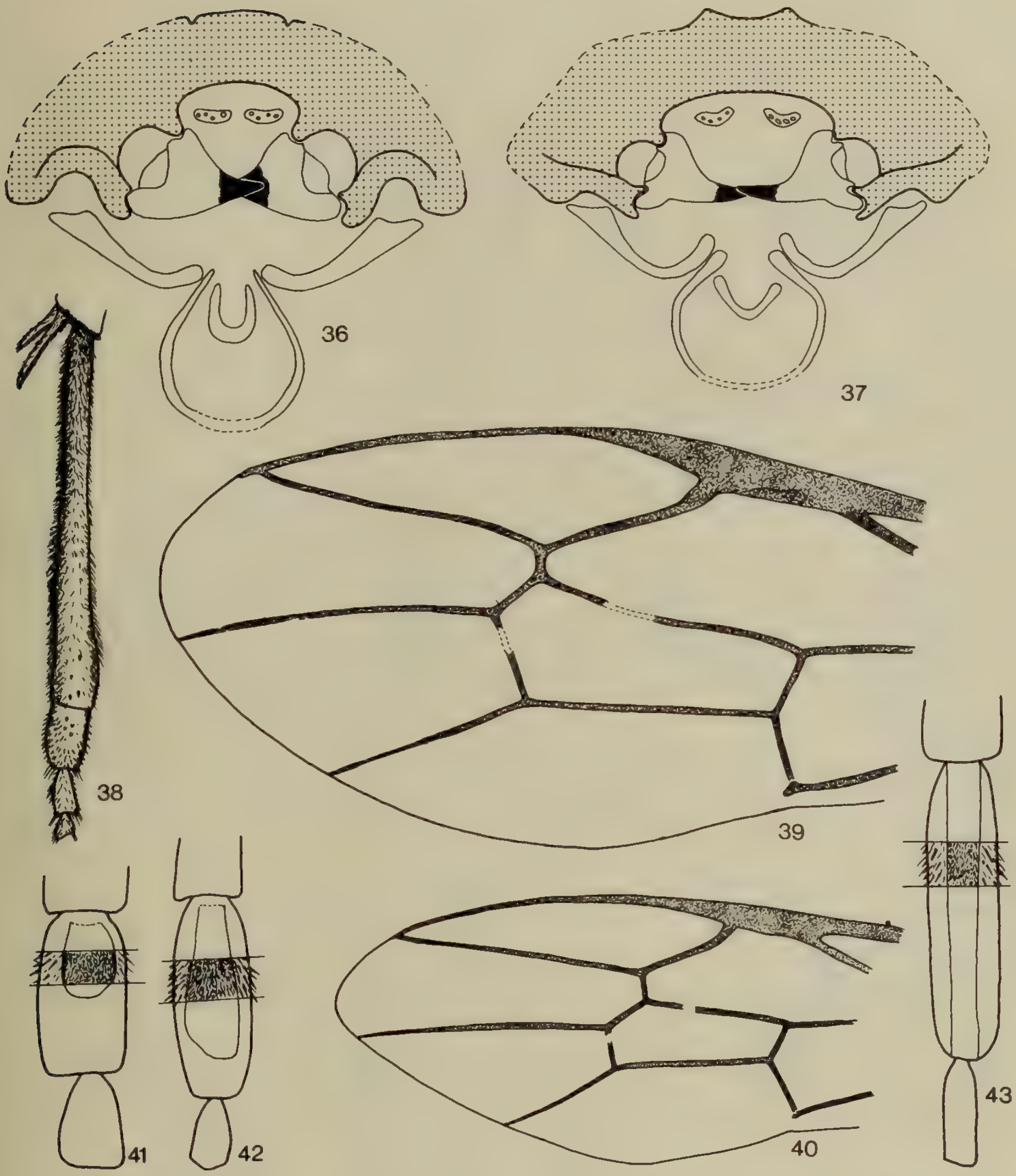

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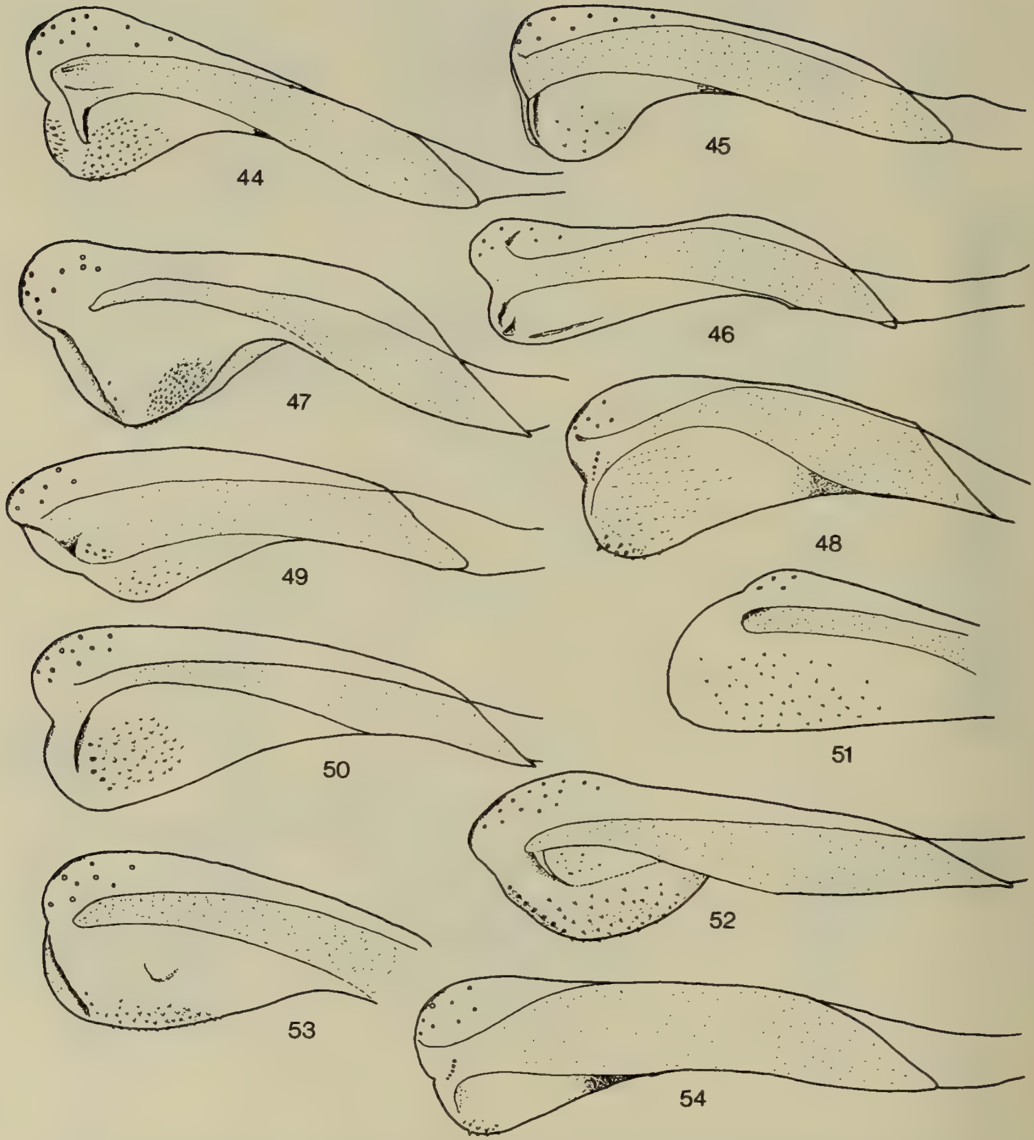

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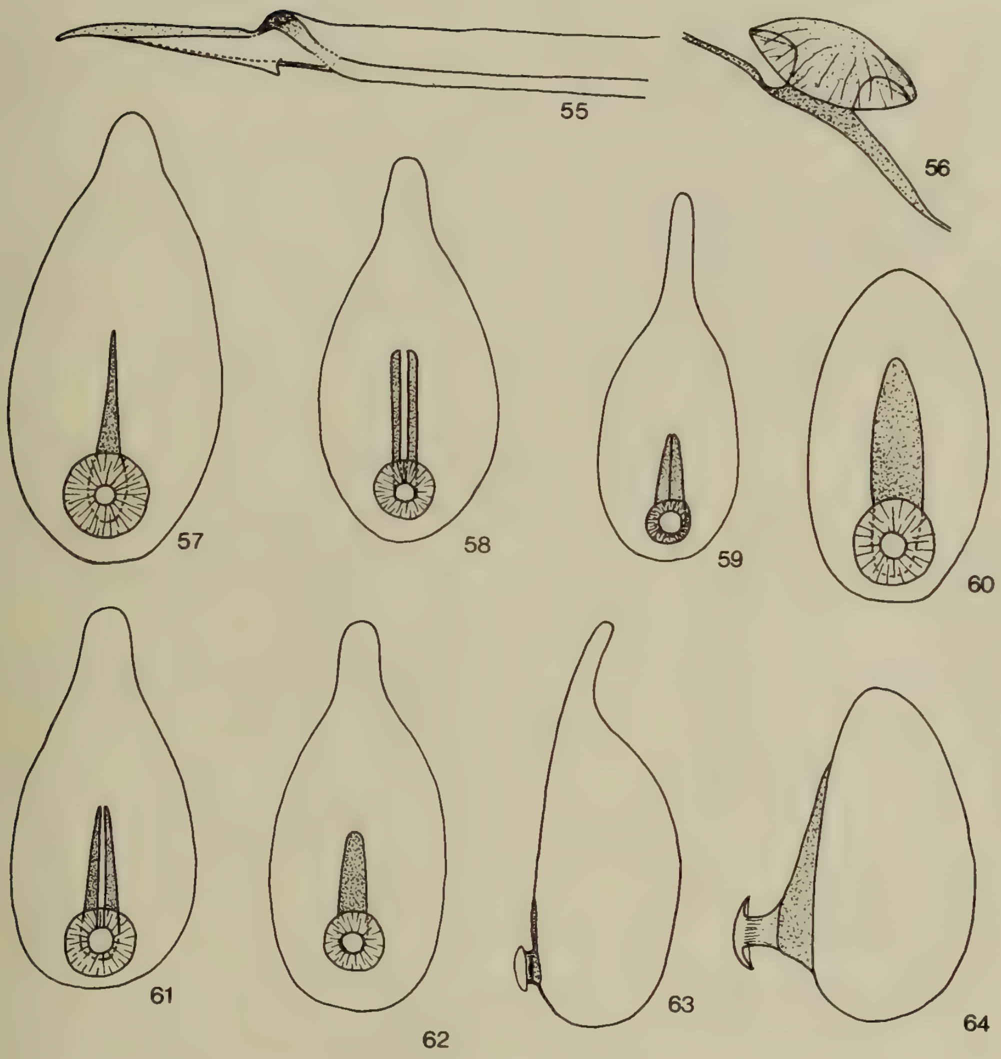

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A REVISION OF THE INDIAN SPECIES OF *HAPLOTHRIPS* AND RELATED GENERA (THYSANOPTERA : PHLAEOTHRIPIDAE)

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A REVISION OF THE INDIAN SPECIES OF *HAPLOTHRIPS* AND RELATED GENERA (THYSANOPTERA : PHLAEOTHRIPIDAE)

By B. R. PITKIN

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SYNOPSIS

Sixty nominal species and two nominal varieties of *Haplothrips* and related genera are discussed. Of these, two species are described as new. The Indian records of three species are refuted. One new generic synonymy, 11 new specific synonymies, and 10 new combinations are established. A key for the identification of the 48 species recorded from India is provided. The characteristic features of each genus and species, a brief discussion of any changes in nomenclature and a list of material examined are given. Lectotypes are designated for 11 species.

INTRODUCTION

There are about 4500 described species of Thysanoptera, although recent work on tropical faunas suggests that there may be more than double this number. Of these about 520 species are recorded from India (Ananthakrishnan, 1969). The Thysanoptera may be divided into two suborders, the Terebrantia and the Tubulifera. The latter comprises a single large family, the Phlaeothripidae, and includes about 2700 described species. Of these about 300 are recorded from India. The Phlaeothripidae may be further divided into two subfamilies, the Idolothripinae and the Phlaeothripinae. The Phlaeothripinae is by far the larger subfamily with about 2300 described species. Of these about 230 species are recorded from India. The Phlaeothripinae may be further subdivided into a number of tribes (Priesner, 1960; Mound, 1972), including the Haplothripini.

The tribe Haplothripini comprises a group of *Haplothrips*-like species with the following diagnostic features: antennae eight-segmented; wings usually present and fully developed, sometimes reduced or absent, when fully developed with or without duplicated cilia; maxillary stylets usually long and retracted far into the head capsule; maxillary bridge usually present; male genitalia with a well developed aedeagus; usually without glandular areas on abdominal sternites. The tribe has a world-wide distribution and comprises more than 300 species. These are found in flowers, at the base of grasses, on dead leaves and branches and as inquilines of galls, but it should be stressed that none of them form galls or cause leaf-rolling as do many species of the tribe Haplothripini. A total of 87 species in 14 genera are recognized from India.

The initial object of this study was to find stable diagnostic characters by which Indian species assigned to the haplothripine genera *Haplothrips* Amyot & Serville and *Xylaplothrips* Priesner could be recognized. Some of these species, however, are more closely related to species in other genera. The study was therefore extended to cover all Indian species listed by Ananthakrishnan (1969) in *Apterygothrips* Priesner, *Chiraplothrips* Priesner, *Haplothrips* Amyot & Serville, *Karnyothrips* Watson, *Praepodothrips* Priesner & Seshadri, *Xenothrips* Ananthakrishnan (**syn. n.** of *Antillothrips* Stannard) and *Xylaplothrips* Priesner, and any species described subsequently from India in these genera. This group includes 45 described species and two new species. The haplothripine genera not included in this account but represented in India, with the exception of *Podothrips* Hood and the monobasic genus *Segnothrips* Ananthakrishnan, may be readily distinguished from *Haplothrips* and related genera using the key characters given by Ananthakrishnan (1969). Species of *Podothrips* may be distinguished from other haplothripines by their praepectal plates, which are longer than broad. *Segnothrips trivandrensis* Ananthakrishnan is being synonymized elsewhere with a species of *Haplothrips* by Dr J. S. Bhatti (pers. comm.).

Six of the seven genera discussed in this account cannot be readily distinguished from each other due to the occurrence of intermediates. Each of these genera, however, exhibits distinct trends and it is on these trends that the generic classification used here is based.

In view of the existence of intermediate species, a workable key to genera would be extremely complex and consequently difficult to use. I have therefore written the key in its present form, rather than as a key to genera followed by keys to the species of each genus. The characters used to distinguish species in different genera are not necessarily significant at the generic level. The characteristics of each genus are discussed separately in the text.

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ABBREVIATIONS

The following abbreviations have been used in the text.

BMNH	British Museum (Natural History), London
LCM	Loyola College, Madras
SMF	Senckenberg Museum, Frankfurt
USNM	United States National Museum, Washington D.C.
TNA	Professor T. N. Ananthakrishnan

INDIAN RECORDS REFUTED

The Indian records of *Apterygothrips flavus* Faure, *Haplothrips flavitibia* Williams and *Xylaplothrips mimus* Priesner are refuted for the reasons given below. The Indian records (Ananthakrishnan, 1969) of *Apterygothrips hispanicus* (Bagnall), *Haplothrips andresi* Priesner and *Haplothrips bagnalli* (Trybom), which are accepted here, require confirmation.

Apterygothrips flavus Faure

Apterygothrips flavus Faure, 1940 : 163. Holotype ♀ aptera, SOUTH AFRICA: Cape Province, Middelburg (National Insect Collection, Pretoria) [not examined].
Apterygothrips flavus Faure; zur Strassen, 1966 : 161–175.

Faure (1940) described *flavus* from nine apterous females and six apterous males collected on *Cenchrus ciliaris* L. [Gramineae] at Middelburg, Cape Province, South Africa. Ananthakrishnan (1967) recorded *flavus* as new to India. None of the specimens on which this Indian record is based represents *flavus*. They are being described elsewhere as a new species of *Apterygothrips* (Dr J. S. Bhatti, pers. comm.).

Haplothrips flavitibia Williams

Haplothrips flavitibia Williams, 1916 : 283–284. Holotype ♀, GREAT BRITAIN: England, Surrey, Merton (Albany Museum, Grahamstown) [examined].

Williams (1916) described *flavitibia* from six specimens, of unspecified sex, beaten from a hedge of hawthorn (*Crataegus oxyacanthoides* Thuillier [Rosaceae]) in Surrey, England in July, 1913 and July, 1914. Priesner (1964*a*) also records *flavitibia* from Germany.

Ananthakrishnan (1952) described a male from Madras collected on the flowers of *Portlandia grandiflora* L. [Rubiaceae] which he incorrectly designated as the holotype male of *flavitibia*. This specimen has the base of the mid and hind tibiae dark brown, whereas *flavitibia* has the mid and hind tibiae completely yellow. Unfortunately I have not examined this Indian male, but in view of the colour differences referred to above it is certainly not *flavitibia*. In the absence of any other published records, the Indian record of *flavitibia* is therefore refuted.

Specimen studied.

Holotype ♀, Great Britain: England, Surrey, Merton, on hawthorn (*Crataegus oxyacanthoides* Thuillier) [Rosaceae], vii. 1913 (*C. B. Williams*) (Albany Museum, Grahamstown).

Xylaplothrips mimus Priesner

Xylaplothrips mimus Priesner, 1939 : 172–174. Holotype ♀, Zaire: Rutshuru (SMF) [not examined].

Priesner (1939) described *mimus* from two females and one male collected on a coffee bush at Rutshuru, Congo (Kinshasa). These specimens apparently have 1 + 1 and 1 + 2 sense cones on antennal segments III and IV respectively. Ananthakrishnan (1966) recorded *mimus* as new to India. This record was based on four females and 11 males collected on grass at Hubli, 21.xi.1964 (*TNA*). I have examined two females collected on grass at Hubli, 17.xi.1964 (*TNA*) and identified by Professor Ananthakrishnan as *mimus*. These specimens, however, have 1 + 2 and $2 + 2^{+1}$ sense cones on antennal segments III and IV respectively and I cannot distinguish them from *pictipes* Bagnall.

CHECKLIST OF THE INDIAN SPECIES OF *HAPLOTHRIPS* AND RELATED GENERA

An asterisk denotes the designation of a lectotype.

Genus ***ANTILLOTHRIPS*** Stannard, 1957
    Xenothrips Ananthakrishnan, 1965*b* **syn. n.**
  graminellus (Ananthakrishnan & Jagadish, 1969) **comb. n.**
  ****malabaricus*** (Ananthakrishnan, 1965*b*) **comb. n.**
    luteus* (Ananthakrishnan & Kudo, 1974) **syn. n.
  micropterus **sp. n.**
  nayari (Ananthrakrishnan, 1958) **comb. n.**
  ****varius*** (Ananthakrishnan & Jagadish, 1969) **comb. n.**
    nefrens (Ananthakrishnan, 1972) **syn. n.**
Genus ***APTERYGOTHRIPS*** Priesner, 1933*a*
  ****fungosus*** (Ananthakrishnan & Jagadish, 1969) **comb. n.**
  hispanicus (Bagnall, 1916)
  ****jogensis*** (Ananthakrishnan & Jagadish, 1969) **comb. n.**
  pellucidus (Ananthakrishnan, 1968) **comb. n.**
  pini Ananthakrishnan, 1961*a*
  rubiginosus (Ananthakrishnan & Jagadish, 1971) **comb. n.**
Genus ***CHIRAPLOTHRIPS*** Priesner, 1930
  graminellus (Priesner, 1938)
    priesneri (Ananthakrishnan, 1961*b*)
Genus ***HAPLOTHRIPS*** Amyot & Serville, 1843
Subgenus ***HAPLOTHRIPS*** Amyot & Serville, 1843
  andresi Priesner, 1928
  bicolor (Ananthakrishnan, 1964*a*) **comb. n.**
  ceylonicus Schmutz, 1913

  - ***ganglbaueri*** Schmutz, 1913
    - *priesnerianus* Bagnall, 1933 **syn. n.**
    - *ceylonicus* var. *vernoniae* Priesner, 1921 **syn. n.**
    - *andhra* Ramakrishna, 1928 **syn. n.**
  - ***gowdeyi*** (Franklin, 1908)
    - *soror* Schmutz, 1913 **syn. n.**
    - *sororcula* Schmutz, 1913 **syn. n.**
  - ***longisetosus*** Ananthakrishnan, 1955
  - ***pirus*** Bhatti, 1967
  - ***reuteri*** (Karny, 1907)
  - ***tenuipennis*** Bagnall, 1918
    - *ceylonicus* var. *mangiferae* Priesner, 1933*b*
- Subgenus ***TRYBOMIELLA*** Bagnall, 1926
  - ***apicalis*** (Bagnall, 1915)
  - ***articulosus*** Bagnall, 1926
    - *derisor* Priesner, 1935
  - ***bagnalli*** (Trybom, 1910)
  - ***clarisetis*** Priesner, 1930
  - ***euphorbiae*** Priesner, 1931
  - ***nigricornis*** Bagnall, 1910
    - *ramakrishnai* Karny, 1926 **syn. n.**
  - ***talpa*** Priesner, 1930
  - ***tirumalraoi*** Ramakrishna & Margabandhu, 1931
- Genus ***KARNYOTHRIPS*** Watson, 1922
  - ***alpha*** **sp. n.**
  - ***flavipes*** (Jones, 1912)
  - ***melaleucus*** (Bagnall, 1911)
  - ***mucidus*** (Ananthakrishnan & Jagadish, 1971) **comb. n.**
  - ***nigriflavus*** Ramakrishna, 1934
- Genus ***PRAEPODOTHIRPS*** Priesner, 1928
  - ***cymbapogoni*** Ananthakrishnan, 1956
  - ***indicus*** Priesner & Seshadri, 1952
  - ****nigrocephalus*** Ananthakrishnan, 1964
  - ***priesneri*** Ananthakrishnan, 1955
- Genus ***XYLAPLOTHRIPS*** Priesner, 1928
  - ***debilis*** Ananthakrishnan & Jagadish, 1971
  - ***emineus*** Ananthakrishnan & Jagadish, 1971
  - ****flavitibia*** Ananthakrishnan, 1969
  - ***flavus*** Ananthakrishnan, 1964*a*
  - ****inquilinus*** (Priesner, 1921)
    - *inquilinus* Ananthakrishnan, 1966 **syn. n.**
    - **longus* Ananthakrishnan & Jagadish, 1969 **syn. n.**
    - **orientalis* Ananthakrishnan & Jagadish, 1969 **syn. n.**
  - ***ligs*** Ananthakrishnan & Jagadish, 1971
  - ***micans*** Ananthakrishnan & Jagadish, 1971
  - ***pictipes*** (Bagnall, 1919)
  - ***pusillus*** Ananthakrishnan & Jagadish, 1969
  - ****tener*** Ananthakrishnan & Jagadish, 1969

KEY TO THE INDIAN SPECIES OF *HAPLOTHRIPS* AND RELATED GENERA

(excluding *longisetosus* Ananthakrishnan (p. 252))

1 Maxillary stylets short, when at rest not retracted far into the head capsule; maxillary bridge absent; praepectal plates weak or absent (cf. Text-figs 1–4) 2

– Maxillary stylets longer, when at rest retracted far into the head capsule; maxillary bridge usually present; praepectal plates usually present and well developed (cf. Text-figs 9–15) 6

2 Body brown.
On dry twigs and *Areca* [Palmae] sheaths . . **Antillothrips varius** (p. 235)

– Body bicoloured, at least abdominal segment II yellow 3

3 Pronotal antero-marginal setae well developed and expanded apically (Text-fig. 4).
On bamboo . . . . **Antillothrips nayari** (p. 235)

– Pronotal antero-marginal setae vestigial (cf. Text-figs 1, 2) 4

4 Pterothorax mainly yellow, light brown at anterior margin only; antennal segments III and IV each with $1 + 1$ sense cones (Text-fig. 6); micropterous.
On bamboo . . . . **Antillothrips micropterus** (p. 234)

– Pterothorax brown; antennal segments III and IV with $1+1$ and $1 + 2^{+1}$ sense cones respectively; macropterous 5

5 Post-ocular and median setae (B_1) on abdominal tergite IX pointed; fore wings with 1–4 duplicated cilia. On bamboo and grass . **Antillothrips malabaricus** (p. 232)

– Post-ocular and median setae (B_1) on abdominal tergite IX expanded apically; fore wings with 5–7 duplicated cilia. On grass and bamboo
Antillothrips graminellus (p. 231)

6 Abdominal tergites III–VII without well developed wing-retaining setae (Text-fig. 16); wings usually reduced or absent 7

– Abdominal tergites III–VII with at least one pair, usually two pairs, of well developed wing-retaining setae (Text-figs 17, 18); wings usually fully developed 11

7 Antennal segment IV with $2 + 2^{+1}$ sense cones 8

– Antennal segment IV with at most $1 + 2$ sense cones 9

8 Antennal segment III with $1 + 1$ sense cones (Text-fig. 25); pronotal mid-lateral setae vestigial (Text-fig. 13). On *Lantana* sp. [Verbenaceae] twigs
Apterygothrips rubiginosus (p. 243)

– Antennal segment III without sense cones (Text-fig. 23); pronotal mid-lateral setae well developed and expanded apically (Text-fig. 12). On dry twigs and fungus-infested branches of *Flacourtia* [Flacourtiaceae] . **Apterygothrips jogensis** (p. 239)

9 Body mainly brown; post-ocular setae pointed.
Tube yellow with brown apex; antennal segment IV with $1 + 1$ sense cones. On pine and dry twigs . . . . **Apterygothrips pini** (p. 241)

– Body mainly yellow; post-ocular setae expanded apically 10

10 Tube brown; antennal segments III and IV with $1 + 1$ and $1 + 1^{+1}$ sense cones respectively; pronotal antero-marginal setae well developed and expanded apically; median setae (B_1) on abdominal tergite IX pointed. Macropterous or apterous. On decaying twigs . . . **Apterygothrips fungosus** (p. 237)

– Tube mainly yellow, extreme apex tinged with brown; antennal segments III and IV with $0 + 1$ and $1 + 2$ sense cones respectively; pronotal antero-marginal setae vestigial; median setae (B_1) on abdominal tergite IX expanded apically. Apterous. On *Sorghum* [Gramineae] and grass . **Apterygothrips pellucidus** (p. 241)

11 Abdominal tergites III–VII with one pair of well developed wing-retaining setae (Text-fig. 17).
Bicoloured species. On *Cynodon* [Gramineae] and other grasses
Haplothrips apicalis (p. 255)

– Abdominal tergites III–VII with two pairs of well developed wing-retaining setae . 12

12 Antennal segment IV with $2 + 2$ or more usually $2 + 2^{+1}$ sense cones (cf. Text-figs 34, 36) . . . 13

– Antennal segment IV with at most $1 + 2^{+1}$ sense cones (cf. Text-figs 30–33) . . . 37

13 Forewings without duplicated cilia . . . 14

– Forewings with duplicated cilia . . . 20

14 Antennal segment III with $0 + 1$ sense cone . . . 15

– Antennal segment III with $1 + 1$ sense cones . . . 16

15 Post-ocular setae short and pointed. In grass flowers . . ***Haplothrips talpa*** (p. 260)

– Post-ocular setae blunt. On *Colocasia* [Araceae] . ***Haplothrips tirumalraoi*** (p. 260)

16 Pronotal antero-marginal setae well developed (cf. Text-fig. 43) . . . 17

– Pronotal antero-marginal setae vestigial . . . 18

17 Pronotal mid-lateral setae well developed (Text-fig. 43). In flowers ***Haplothrips articulosus*** (p. 257)

– Pronotal mid-lateral setae vestigial (cf. Faure, 1955 : fig. 8). In flowers ***Haplothrips clarisetis*** (p. 258)

18 Post-ocular setae minute; pronotal epimeral setae greatly expanded (Text-fig. 44); median setae (B_1) on abdominal tergite IX expanded apically. On *Euphorbia* [Euphorbiaceae] . . . ***Haplothrips euphorbiae*** (p. 259)

– Post-ocular setae well developed and expanded apically; epimeral setae not greatly expanded; median setae (B_1) on abdominal tergite IX pointed or blunt . . . 19

19 Pronotal antero-angular and postero-angular setae fairly well developed (cf. Faure, 1955 : fig. 4). In flowers . . . ***Haplothrips bagnalli*** (p. 258)

– Pronotal antero-angular and postero-angular setae vestigial (cf. Faure, 1955 : fig. 1). In flowers . . . ***Haplothrips nigricornis*** (p. 259)

20 Pronotal antero-marginal setae well developed . . . 21

– Pronotal antero-marginal setae vestigial . . . 35

21 Antennal segment III with $0 + 1$ sense cones . . . 22

– Antennal segment III with $1 + 1$ or $1 + 2$ sense cones . . . 25

22 Post-ocular setae pointed or blunt (Text-fig. 40). In flowers ***Haplothrips andresi*** (p. 244)

– Post-ocular setae expanded apically . . . 23

23 Mid- and hind-tibiae brown with yellow apices. In flowers ***Haplothrips ceylonicus*** (p. 248)

– Mid and hind tibiae brown . . . 24

24 Aedeagus of male bifid at apex (cf. Bhatti, 1973 : fig 3). In flowers of wheat ***Haplothrips bagrolis*** (p. 245)

– Aedeagus of male simple. In flowers of Gramineae ***Haplothrips ganglbaueri*** (p. 249)

25 Antennal segment III $1 + 1$ sense cones . . . 26

– Antennal segment III with $1 + 2$ sense cones . . . 30

26 Body bicoloured, abdominal segments III–VII yellow with small median, pale brown patches. In psyllid galls . . . ***Haplothrips bicolor*** (p. 248)

– Body brown or almost entirely yellow . . . 27

27 Body yellow except apex of tube. In leaf mines on *Syzygium* [Myrtaceae] . . . ***Haplothrips pirus*** (p. 253)

– Body brown . . . 28

28 Post-ocular and pronotal epimeral setae pointed (Text-fig. 40). In flowers . . . ***Haplothrips reuteri*** (p. 253)

– Post-ocular and pronotal epimeral setae expanded apically (cf. Text-fig. 39) . . . 29

29 Mid and hind tibiae and tarsi brown. In flowers . ***Haplothrips gowdeyi*** (p. 250)

– Mid and hind tibiae yellow at apex, all tarsi yellow. In flowers ***Haplothrips tenuipennis*** (p. 254)

30 Head brown, pronotum yellow. On dry twigs . . . ***Xylaplothrips emineus*** (p. 269)

– Head and pronotum brown 31

31 Abdominal segments III–IX distinctly paler than head, grey-yellow with median transverse brown patches. On fungus-infested *Areca* [Palmae] sheaths and dry *Smilax* [Liliaceae] twigs **Xylaplothrips pusillus** (p. 274)

– Abdominal segments III–IX brown, not distinctly paler than head 32

32 Hind tibiae dark brown except at base.
On bamboo **Praepodothrips priesneri** (p. 268)

– Hind tibiae yellow to brown but never brown at apex 33

33 Antennal segments IV and V yellow at base, pale brown at apex.
In palm inflorescences **Xylaplothrips flavus** (p. 270)

– Antennal segments IV and V brown 34

34 Fore tarsi unarmed. On try twigs **Xylaplothrips tener** (p. 276)

– Fore tarsi with small claws. On dry berries and grass **Xylaplothrips pictipes** (p. 274)

35 Antennal segment III with 1 + 1 sense cones. Body mainly yellow.
On dry and decaying twigs and bark **Xylaplothrips micans** (p. 273)

– Antennal segment III with 1 + 2 sense cones. Body mainly brown 36

36 Hind tibiae yellow. In galls **Xylaplothrips flavitibia** (p. 270)

– Hind tibiae tinged with brown. In galls **Xylaplothrips inquilinus** (p. 272)

27 Pronotal antero-marginal setae well developed and expanded apically 38

– Pronotal antero-marginal setae vestigial or pointed 40

38 Antennal segment III with 0 + 1 sense cone (Text-fig. 58).
On dry twigs **Xylaplothrips ligs** (p. 273)

– Antennal segment III with 1 + 1 sense cones 39

39 Head and pronotum yellow-brown, distinctly paler than antennal segments IV–VIII. On decaying twigs **Apterygothrips fungosus** (p. 237)

– Head and pronotum brown, concolourous with or slightly darker than antennal segments IV–VIII. On dry twigs **Xylaplothrips debilis** (p. 268)

40 Antennal segment IV with 1 + 1 sense cones; post-ocular setae pointed or blunt 41

– Antennal segment IV with $1 + 1^{+1}$, $1 + 2$, or $1 + 2^{+1}$ sense cones; post-ocular setae expanded apically 45

41 Head relatively large; cheeks convex; head distinctly narrower across base 42

– Head not unusually large; cheeks more or less parallel; head not noticeably narrower across base 44

42 Body brown.
Antennal segment III with 1 + 1 sense cones (Text-fig. 46); fore wings with 5–7 duplicated cilia. On *Cymbopogon* [Gramineae] and other grasses
Praepodothrips cymbapogoni (p. 265)

– Body bicoloured 43

43 Thorax brown. Antennal segment III with 1 + 1 sense cones (Text-fig. 49); fore wings with 4–8 duplicated cilia. On grass **Praepodothrips indicus** (p. 267)

– Thorax yellow. Antennal segment III with 0 + 1 sense cones (Text-fig. 51); fore wings without duplicated cilia. On grass **Praepodothrips nigrocephalus** (p. 267)

44 Antennal segment III with 0 + 1 sense cones; antennal segments III–VI and fore legs short and stout; pronotal epimeral setae pointed. On grass
Chiraplothrips graminellus (p. 243

– Antennal segment III with 1 + 1 sense cones; antennal segment III–VI and fore legs slender; pronotal epimeral setae slightly expanded apically. On grass
Apterygothrips hispanicus (p. 239

45 Body brown.
Antennal segments III and IV with 1 + 1 and $1 + 2^{+1}$ sense cones respectively; fore wings with 1–5 duplicated cilia. On numerous plants, predatory on scales, whitefly and mites **Karnyothrips flavipes** (p. 262)

– Body bicoloured 46

46 Prothorax yellow; fore wings without duplicated cilia.
Antennal segments III and IV with $0 + 1$ and $1 + 2$ sense cones respectively; median setae (B_1) on abdominal tergite IX pointed. On bamboo, sugarcane and grass . . . . **Karnyothrips alpha** (p. 261)
– Prothorax brown; at least one duplicated cilium on one of the fore wings . . 47
47 Pterothorax yellow.
Antennal segments III and IV with $0 + 1$ and $1 + 2$ sense cones respectively; median setae (B_1) on abdominal tergite IX expanded apically. On bamboo and grass . . . . **Karnyothrips nigriflavus** (p. 264)
– Pterothroax brown 48
48 Antennal segments III and IV with $1 + 1$ and $1 + 1^{+1}$ sense cones respectively (Text-fig. 30); median setae (B_1) on abdominal tergite IX pointed or blunt. On numerous plants, probably predatory . . **Karnyothrips melaleucus** (p. 263)
– Antennal segments III and IV with $0 + 1$ and $1 + 2^{+1}$ sense cones respectively; median setae (B_1) on abdominal tergite IX expanded apically. On dry twigs **Karnyothrips mucidus** (p. 264)

GENERA AND SPECIES DISCUSSED ALPHABETICALLY

ANTILLOTHRIPS Stannard

Antillothrips *Stannard*, 1957 : 35–36. Type-species: *Antillothrips graminatus* Stannard [= *Zygothrips cingulatus* Hood], by original designation.

Xenothrips Ananthakrishnan, 1965*a* : 53. Type-species: *Xenothrips malabaricus* Ananthakrishnan, by original designation. **Syn. n.**

The genus *Antillothrips* was erected by Stannard (1957) for *graminatus*, which was subsequently synonymised with *Zygothrips cingulatus* Hood (Pitkin, 1973). This species is a widespread, tropical, grass-living thrips recorded from Australia, Solomon Is., New Britain, U.S.A. (Florida), Jamaica and Trinidad. I have recently collected a single female of this bicoloured species in Tanzania.

The monotypic genus *Xenothrips* was erected by Ananthakrishnan (1965) for the Indian species *malabaricus*, here transferred to *Antillothrips*. A further three Indian species formerly assigned to *Xylaplothrips* are also transferred here to *Antillothrips* and one new species is described. Four of the five Indian species recognized here are bicoloured and are associated with grasses.

Generic definition. Small to medium sized, bicoloured or brown species of Haplothripini. Maxillary stylets short, when at rest not retracted far into the head capsule; maxillary bridge absent; post-ocular setae pointed to expanded. Antennal segment III with $0 + 1$ or $1 + 1$ sense cones; segment IV with $1 + 2^{+1}$ or $1 + 1$ sense cones. Pronotal antero-marginal and mid-lateral setae well developed or vestigial; praepectal plates weakly developed or absent. Wings usually fully developed and either with or without duplicated cilia on fore wings; more rarely reduced. Abdominal tergites III–VII usually with two pairs of well developed wing-retaining setae.

Antillothrips graminellus (Ananthakrishnan & Jagadish) comb. n.

(Text-figs 1, 5)

Xylaplothrips graminellus Ananthakrishnan & Jagadish, 1969 : 123–124. Syntypes 5 ♀, 2 ♂ India: Tirupathi (LCM) [3 ♀ examined].

Bicoloured species; head, thorax, abdominal segments VIII–X brown; antennal segments I and II pale brown, segments IV–VI pale brown in apical half to two-thirds, segments VII and VIII brown; remainder yellow.

Antennal segments III and IV with $1 + 1$ and $1 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; macropterous, fore wings with 5–7 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

This species was described from five females and two males collected at Tirupathi on grass. No holotype was designated in the original description although the three syntype females examined are labelled as paratypes. The additional female examined, from Tumkur on bamboo, had been incorrectly labelled as a male of *Xylaplothrips nayari*.

SPECIMENS STUDIED.

Syntypes 3 ♀, INDIA: Tirupathi, on grass, 6.xi.1694 (*TNA*) (LCM).
INDIA: Tumkur, 1 ♀ on bamboo, 5.ix.1967 (*TNA*) (BMNH).

Antillothrips malabaricus (Ananthakrishnan) **comb. n.**

Xenothrips malabaricus Ananthakrishnan, 1965*b* : 53–54. LECTOTYPE ♀, INDIA: Chalakudi (Kerala) (LCM), here designated [examined).

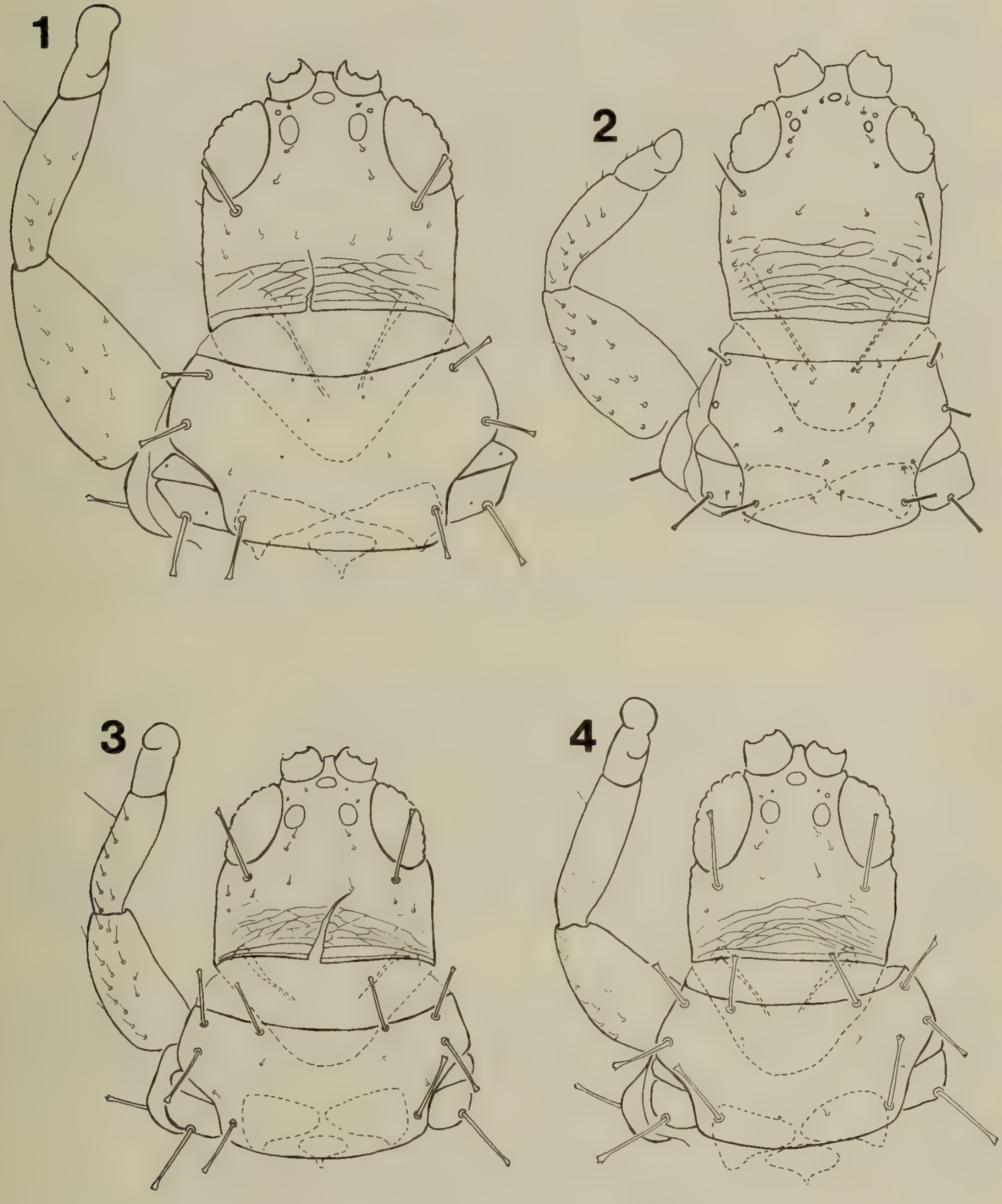
Xenothrips luteus Ananthakrishnan & Kudo, 1974 : 119–120. LECTOTYPE ♀, INDIA: Palghat (LCM), here designated [examined]. **Syn. n.**

Bicoloured species; head, thorax, abdominal segments VII or VIII–X brown; antennal segments I and II yellow tinged with brown, particularly at margins; antennal segment VI brown in distal half; antennal segments VII and VIII brown; outer basal portion of fore femora, particularly of male, brown; remainder yellow.

Antennal segments III and IV with $1 + 1$ and $1 + 2^{+1}$ sense cones respectively; post-ocular setae pointed; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; macropterous, fore wings with 1–4 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from '2 macropterous, 4 brachypterous females and 2 brachypterous males' (Ananthakrishnan, 1965*b*) and not 'only apterous males and females' (Ananthakrishnan, 1968). No holotype was designated in the original description and unfortunately the four syntypes that I have examined represent two distinct congeneric species. Moreover one female, labelled 'HOLOTYPE', and one male, labelled 'Paratype', are macropterous and one female, labelled 'PARATYPE', and one male, labelled 'ALLOTYPE', are micropterous. The macropterous female labelled 'HOLOTYPE' is here designated as the lectotype of *malabaricus*. The macropterous male labelled 'Paratype' is regarded as a paralectotype of *malabaricus*. The micropterous female labelled 'PARATYPE' and the micropterous male labelled 'ALLOTYPE' are described below as a new species of *Antillothrips*. The identity of the remaining four syntypes, which I have not examined, remains in doubt.

Contrary to the original description the lectotype female has one duplicated cilium on each fore wing. The male paralectotype has one duplicated cilium on the right fore wing and two on the left fore wing. Three other specimens from



FIGS 1–4. *Antillothrips* species: heads, pronota and left forelegs. 1, *graminellus*, paratype ♀. 2, *micropterus*, holotype ♀. 3, *varius*, ♀. 4, *nayari*, ♀.

Coimbatore that I have examined have up to four duplicated cilia on the fore wing. All of these specimens have a brown, not yellow, prothorax and abdominal segment IX.

Xenothrips luteus (Ananthakrishnan & Kudo, 1974) was described from two females from Palghat on grass, 17.ii.1967 and one male from Chalakudi on dry grass, 5.xii.1963. No holotype was designated in the original description. One of the two female syntypes has been examined and this is labelled 'HOLOTYPE'. This specimen is here designated as the lectotype of *luteus*. The above synonymy is based on comparison of this specimen with the lectotype and paralectotype of *malabaricus*.

Ananthakrishnan & Kudo (1974) described a subspecies of *luteus* from Thailand which they called *exastis*. I have examined a syntype of this subspecies labelled 'HOLOTYPE' and it is my opinion that this represents a distinct species. The status of *exastis* will be dealt with elsewhere, since it lies beyond the scope of this paper.

SPECIMENS STUDIED.

Lectotype ♀, paralectotype ♂ of *malabaricus*, INDIA: Chalakudi (Kerala) on bamboo, 5.xii.1965 (*TNA*) (LCM). Lectotype ♀ of *luteus*, INDIA: Palghat, grass, 17.xi.1967 (*TNA*) (LCM).

INDIA: Coimbatore, 2 ♀, 1 ♂ on grass stumps, 24.vi.1973 (*J. S. Bhatti*) (Hans Raj College, Delhi).

***Antillothrips micropterus* sp. n.**

(Text-figs 2, 6)

This species is described from a micropterous female and male originally misidentified and described as syntypes of *malabaricus* (cf. p. 232). It may be readily distinguished from the latter by the mainly yellow pterothorax and from all species of *Antillothrips* by the short wings and presence of only 1 + 1 sense cones on antennal segment IV.

Bicoloured species of *Antillothrips*; head, pronotum and distal half of tube brown; pterothorax mainly yellow, anterior margin tinged with brown; abdominal segments II–IX and basal half of tube yellow; fore femora brown except at apex; fore tibiae and tarsi yellow; mid and hind legs yellow.

Antennal segments III and IV each with 1 + 1 sense cones; post-ocular setae pointed; pronotal antero-marginal setae vestigial; mid-lateral setae well developed and expanded apically; micropterous; median setae (B_1) on abdominal tergite IX pointed.

Measurements in μm of holotype female (paratype male): total length 1360 (950, contracted); head length 171 (153); pronotal length 114 (108); tube length 87 (72); tube width at base 51 (45).

Holotype ♀ microptera, INDIA: Chalakudi, on bamboo, 5.xii.1963 (*TNA*) (LCM). Paratype. INDIA: 1 ♂ microptera, same date as holotype (LCM).

Antillothrips nayari (Ananthakrishnan) **comb. n.**

(Text-figs 4, 7)

Xylaplothrips nayari Ananthakrishnan, 1958 : 278–280. Holotype ♀, INDIA: Trivandrum (LCM) [not examined].

Bicoloured species; head, antennae (except segment III), thorax, and tube brown; abdominal segments III–IX pale brown to yellow brown, segments III–V of female darker then segments VI–IX; femora and tibiae yellow tinged with brown; pelta and abdominal segment II yellow.

Antennal segments III and IV with 1 + 1 and 1 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 3–6 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

This species was described from a holotype, an allotype and 'numerous males and females' from Trivandrum on bamboo leaf sheaths, ii. 1957 (*K. K. Naya*). I have not seen any of these specimens. The above diagnosis is based on the original description and six females and six males identified by Professor Ananthakrishnan.

SPECIMENS STUDIED.

INDIA: Thalachira, 6 ♀, 6 ♂ on bamboo sheath, 2.ix.1966 (*TNA*) (USNM; BMNH).

Antillothrips varius (Ananthakrishnan & Jagadish) **comb. n.**

(Text-figs 3, 8)

Xylaplothrips varius Ananthakrishnan & Jagadish, 1969 : 132. LECTOTYPE ♀, INDIA: Adur, Kerala (LCM), here designated [examined].

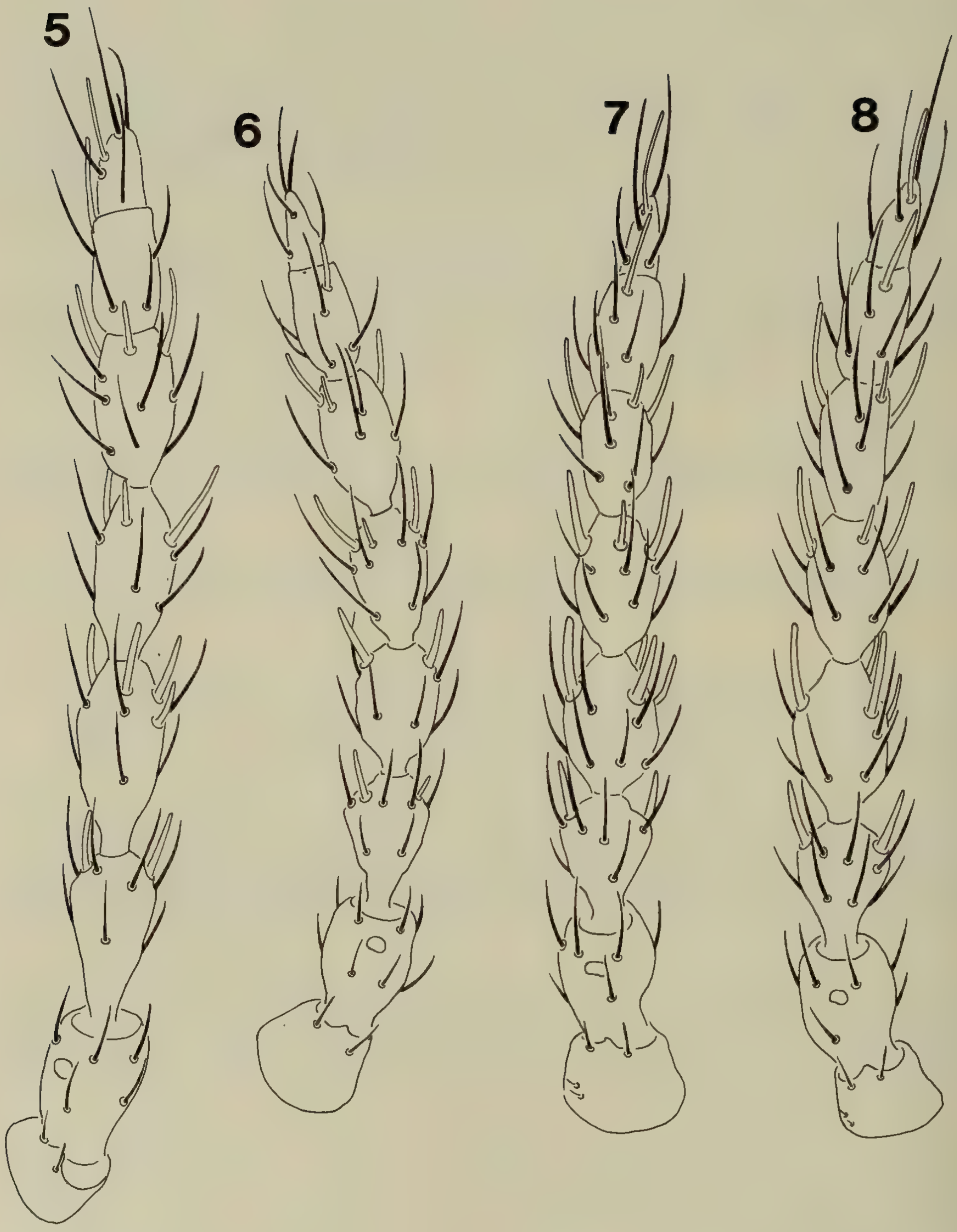
Xylaplothrips nefrens Ananthakrishnan, 1972 : 442–443. Holotype ♀, INDIA: U.P. Dehra Dun (LCM) [examined]. **Syn. n.**

Brown species with antennal segment III, apex of fore femora, and base and apex of tibiae yellow.

Antennal segments III and IV with 1 + 1 and 1 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 3–5 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Antillothrips varius was originally described from three females and one male collected on *Areca* sheaths at Adur, India. No holotype was designated although one female syntype is labelled 'HOLOTYPE' and at least one other female syntype is labelled 'PARATYPE'. The male syntype is labelled 'ALLOTYPE'. The female labelled 'HOLOTYPE' is here designated as the lectotype of *varius*.

Antillothrips nefrens was originally described from 17 females, including the holotype, and five males collected on dry twigs at Dehra Dun, India. Ananthakrishnan (1973) distinguished *varius* and *nefrens* on whether both setae B_1 and B_2 on abdominal tergite IX were pointed or not. All of the type-material of both species that I have examined has setae B_1 expanded apically and setae B_2 pointed or blunt. I therefore regard *nefrens* as a synonym of *varius*.



FIGS 5–8. *Antillothrips* species: antennae. 5, *graminellus*, paratype ♀. 6, *micropterus*, holotype ♀. 7, *nayari*, ♀. 8, *varius*, ♀.

SPECIMENS STUDIED.

Lectotype ♀, paralectotypes 1 ♀, 1 ♂ of *varius*, INDIA: Adur, Kerala on *Areca* [Palmae] sheaths, 28.vi.1967 (*TNA*) (LCM). Holotype ♀, paratypes 2 ♀, 2 ♂ of *nefrens*, INDIA: U.P. Dehra Dun, on dry twigs, 12.x.1971 (*TNA*) (LCM; USNM).

APTERYGOTHRIPS Priesner

Apterygothrips Priesner, 1933*a* : 1. Type-species: *Apterygothrips haloxyli* Priesner, by original designation.

Zur Strassen (1966) recognized eight species of *Apterygothrips* and provided a key for their identification. Of these, five occur in the Mediterranean region, one in southern Africa, one in southern India, and one apparently in the Mediterranean region and India (cf. p. 239). A further species has been described more recently from Australia (Pitkin, 1973). Four Indian species formerly assigned to *Xylaplothrips* are here transferred to *Apterygothrips*. A total of six species are recognized here from India, although the Indian record of *hispanicus* (Bagnall) requires confirmation. Species of *Apterygothrips* are associated with grasses and dead wood.

GENERIC DEFINITION. Small to medium sized yellow, brown or bicoloured Haplothripini. Maxillary stylets long, when at rest retracted far into the head capsule, maxillary bridge usually present; ocelli sometimes reduced or absent; post ocular setae pointed or expanded apically. Antennal segment III with at most 1 + 1 sense cones. Pronotal antero marginal and mid lateral setae well developed or vestigial. Usually apterous and without well developed wing-retaining setae on abdominal tergites III–VII, sometimes macropterous and with two pairs of well developed wing-retaining setae on each of abdominal tergites III–VII; fore wings, if fully developed, with or without duplicated cilia.

Apterygothrips fungosus (Ananthakrishnan & Jagadish) **comb. n.**

(Text-fig. 19)

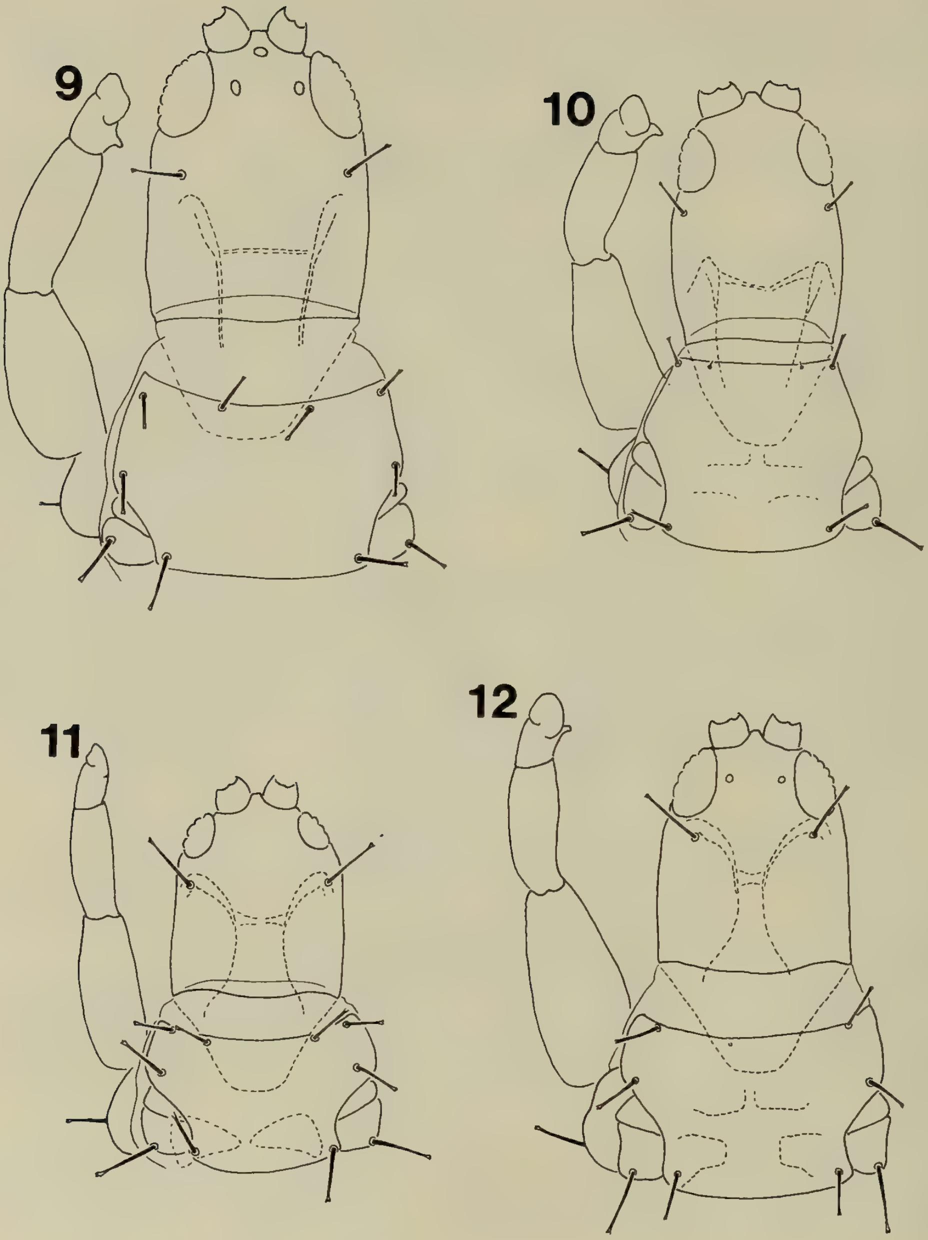
Xylaplothrips fungosus Ananthakrishnan & Jagadish, 1969 : 132–133. LECTOTYPE ♀ macroptera, INDIA: Madras (LCM), here designated [examined].

Yellow-brown species with antennal segment IV–VIII and tube except base distinctly brown. Antennal segments III and IV with 1 + 1 and 1 + 1^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; apterous or macropterous, fore wings when fully developed with 1–5 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from a total of six females and six males. None of these specimens was designated as the holotype although one of the female syntypes examined is labelled 'HOLOTYPE'. This specimen, contrary to the original description, is macropterous and is here designated as the lectotype.

SPECIMENS STUDIED.

Lectotype ♀ macroptera, paralectotypes 2 ♀ apterae, INDIA: Madras, decaying twigs, 25.vii.1967 (*TNA*) (LCM; USNM).



Figs 9–12. *Apterygothrips* and *Haplothrips* species: heads, pronota and left forelegs. 9, *H. apicalis*, lectotype ♀. 10, *A. flavus*, paratype ♀ (African specimen). 11, *A. fungosus*, paratype ♀. 12, *A. jogensis*, ♀.

Apterygothrips hispanicus Bagnall

Cephalothrips hispanicus Bagnall, 1916 : 409–411. Holotype ♀, SPAIN: Zaragosa (BMNH) [examined].
Malacothrips hispanicus (Bagnall) Bagnall, 1924 : 635.
Apterygothrips hispanicus (Bagnall) Priesner, 1961 : 56.

Brown species; antennal segment III yellow; antennal segments IV–VI yellow tinged with brown; antennal segments VII and VIII pale brown; all femora brown; all tibiae brown at base becoming pale yellow at apex.

Antennal segments III and IV each with 1 + 1 sense cones; post-ocular setae pointed; pronotal antero-marginal setae moderately well developed and pointed; mid-lateral setae well developed and blunt to expanded; macropterous, wings often broken; fore wings without duplicated cilia (zur Strassen, 1966); median setae (B_1) on abdominal tergite IX pointed.

Bagnall (1923) recorded a single male of *hispanicus* from the flower of *Rhododendron* at Kulhara, Garhwal. The references by Bagnall (1924), Priesner (1928) and Ananthakrishnan (1969) of *hispanicus* from India appear to refer to this specimen. As far as I am aware no other published records of *hispanicus* in India exist. Since it is possible that Bagnall accidentally mis-labelled his specimen, the Indian record of *hispanicus* requires confirmation.

SPECIMENS STUDIED.

Holotype ♀, paratype ♀, SPAIN: Zaragosa, 8.iv.1913 (*Navás*) (BMNH).

?INDIA: Kulhara, Garwal, 11,700 ft, 1 ♂ on flower of *Rhododendron*, 5.vii.1970 (*A. D. Imms*) (BMNH).

Apterygothrips jogensis (Ananthakrishnan & Jagadish) **comb. n.**

(Text-figs 12, 23)

Xylaplothrips jogensis Ananthakrishnan & Jagadish, 1969 : 124–125. LECTOTYPE ♀ aptera, INDIA: Jog Falls (LCM), here designated [examined].

Brown species with apex of tibiae and tarsi yellow; antennal segment III yellow at base darkening towards apex to pale brown.

Antennal segments III and IV with 0 + 0 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial; mid-lateral setae well developed and expanded apically; apterous; median setae (B_1) on abdominal tergite IX pointed or blunt.

This species was originally described from four females and two males collected from fungus infested branches of *Flacourtia* sp. [Flacourtiaceae] at Jog Falls, India. None of these specimens was designated as the holotype. The two females and one male that I have examined are labelled 'HOLOTYPE', 'PARATYPE', and 'ALLOTYPE' respectively. The female labelled as the holotype is here designated lectotype.

SPECIMENS STUDIED.

Lectotype ♀ aptera, paralectotypes 1 ♀ aptera, 1 ♂ aptera, INDIA: Jog Falls, on fungus infested branches of *Flacourtia* sp., 22.x.1966 (*TNA*) (LCM; USNM).

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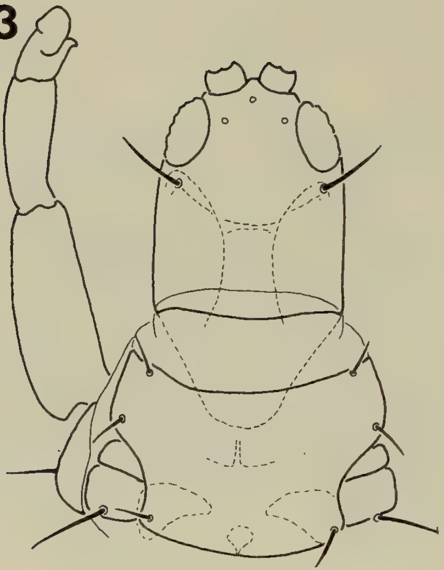

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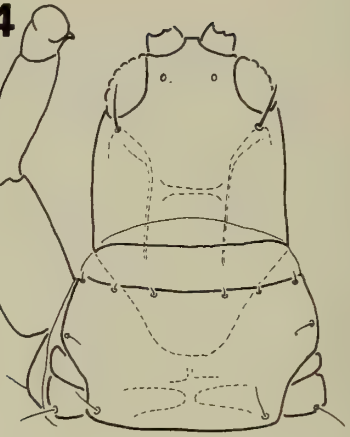

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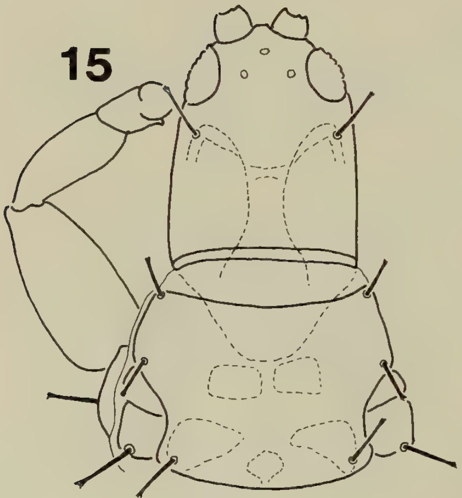

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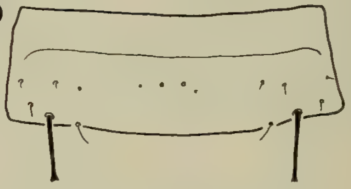

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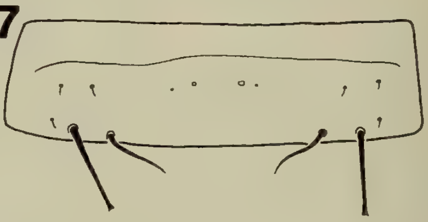

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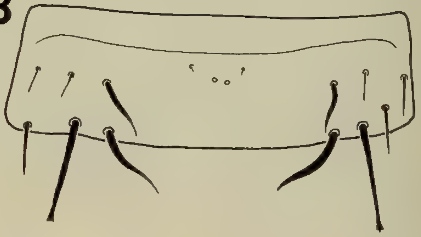


Figs 13–18. 13–15. *Apterygothrips* species: heads, pronota and left forelegs of (13) *rubiginosus*, ♀; (14) *pini*, ♀; (15) *pelludicus*, paratype ♀. 16–18, abdominal tergite IV of (16) *Apterygothrips pellucidus* paratype ♂; (17) *Haplothrips apicalis*, ♀; 18, *H. ganglbaueri* (paralectotype ♀ of *priesnerianus*).

Apterygothrips pellucidus (Ananthakrishnan) **comb. n.**

(Text-figs 15, 16, 21)

Xylaplothrips pellucidus Ananthakrishnan, 1968 : 133. Holotype ♀ aptera, INDIA: Madras (LCM) [not examined].

Mainly yellow species with antennal segments V–VIII brown; mesonotum and extreme apex of tube tinged with brown.

Antennal segments III and IV with 0 + 1 and 1 + 2 sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; apterous; median setae (B_1) on abdominal tergite IX expanded apically.

This species was originally described from a holotype female, an allotype male, and 27 female and 17 male paratypes which are all apparently apterous. The specimens examined from Kalahasti, India and Taimergarha, Pakistan had been misidentified as *flavus* Faure.

SPECIMENS STUDIED.

Paratypes 1 ♀ aptera, 1 ♂ aptera, INDIA: Madras, on *Sorghum* [Gramineae] leaves, 12.xi.1965 (*TNA*) (USNM).

?Paratypes 2 ♂ aptera, INDIA: Madras, on *Sorghum* leaves, 12.xi.1965 (*TNA*) (BMNH).

INDIA: Madras, 1 ♀ aptera on grass, 6.vii.1966 (*TNA*) (BMNH); Kalahasti, 1 ♀ aptera on grass, 9.ix.1964 (*TNA*) (BMNH). PAKISTAN: Taimergarha, 1 ♂ aptera on *Cynodon dactylon* (L.) Persoon [Gramineae] 30.i.1964 (*CIBC*) (BMNH).

Apterygothrips pini Ananthakrishnan

(Text-figs 14, 22)

Apterygothrips pini Ananthakrishnan, 1961*a* : 574–575. Holotype ♀ aptera, INDIA: Kodaikanal, Bryant's Park (LCM) [examined].

Apterygothrips pini Ananthakrishnan; zur Strassen, 1966 : 161–175.

Pale brown species with bicoloured tube and antennal segment III paler than other segments.

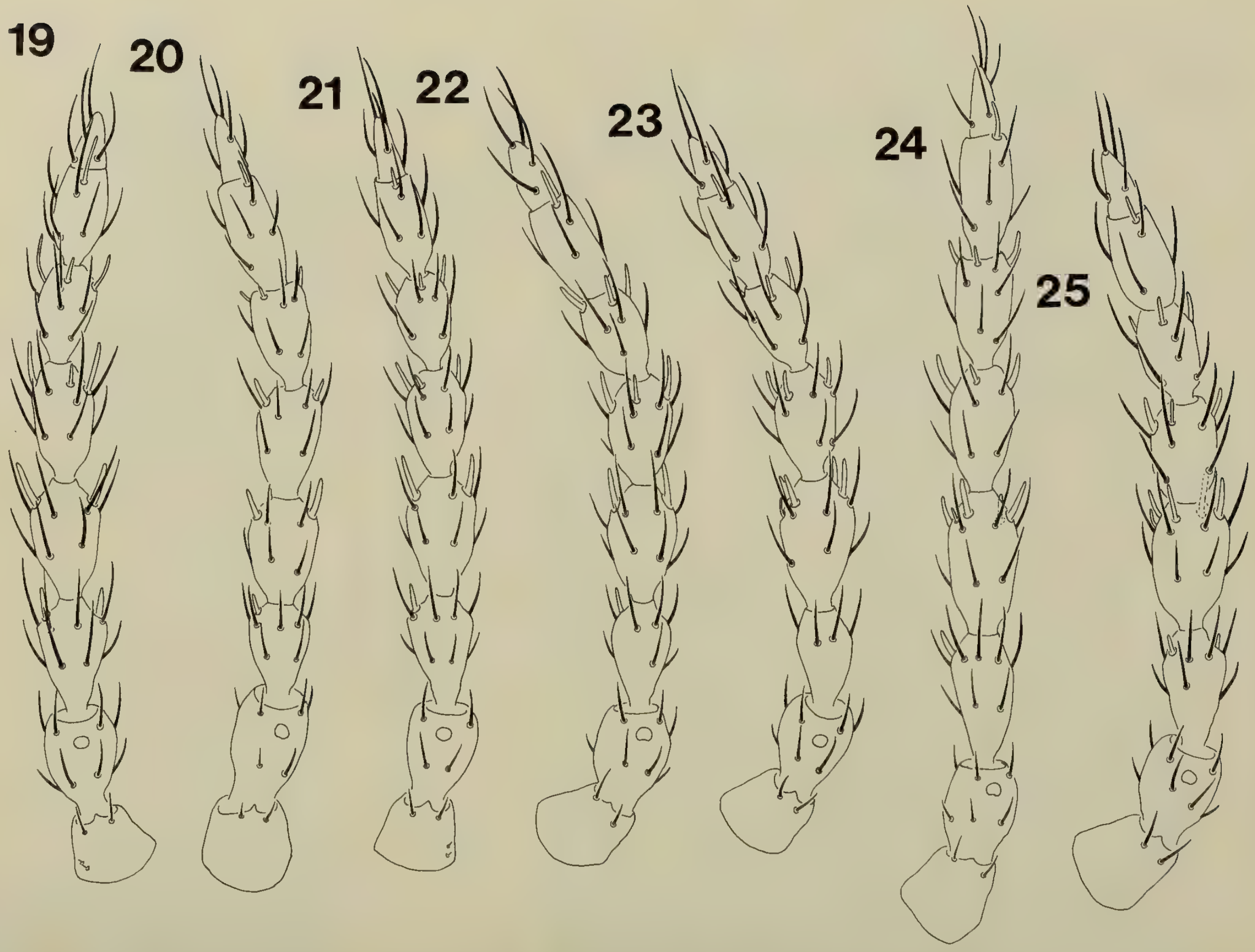
Antennal segments III and IV with 0 + 1 and 1 + 1 sense cones respectively; post-ocular setae pointed; pronotal antero-marginal setae vestigial, mid-lateral setae fairly well developed but pointed; apterous; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from three females and two males from pine needles. I have examined further material from dry twigs.

SPECIMENS STUDIED.

Holotype ♀ aptera, allotype ♂ aptera, INDIA: Kodaikanal, Bryant's Park, on pine needles, 4.vi.1959 (*TNA*) (LCM).

INDIA: Kodaikanal, 7 ♀ apterae on dry twigs, 2.i.1969 (*TNA*) (BMNH; LCM).



FIGS 19–25. *Apterygothrips* and *Haplothrips* species: antennae. 19, *A. fungosus*, paratype ♀. 20, *A. flavus*, paratype ♀ (African specimen). 21, *A. pellucidus*, paratype ♀. 22, *A. pini*, holotype ♀. 23, *A. jogensis*, ♀. 24, *H. apicalis*, lectotype ♀. 25, *A. rubiginosus*, paratype ♀.

Apterygothrips rubiginosus (Ananthakrishnan & Jagadish) **comb. n.**

(Text-figs 13, 25)

Xylaplothrips rubiginosus Ananthakrishnan & Jagadish, 1971 : 263–264. Holotype ♀ aptera, INDIA: Kodaikanal, *Lantana* sp. twigs (LCM) [examined].

Brown species with apex of tibiae yellow; antennal segment III yellow to grey-brown.

Antennal segments III and IV with 1 + 1 and $2 + 2^{+1}$ sense cones respectively; post-ocular setae pointed; pronotal antero-marginal and mid-lateral setae vestigial; apterous; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from a holotype female, an allotype male and six female and four male paratypes, all apparently apterous.

SPECIMENS STUDIED.

Holotype ♀ aptera, allotype ♂ aptera, INDIA: Kodaikanal, *Lantana* sp. twigs, 1.i.1969 (*TNA*) (LCM).

?Paratype ♀ aptera, INDIA: Kodaikanal, *Lantana* sp. twigs, 1.i.1969 (*TNA*) (LCM).

CHIRAPLOTHRIPS Priesner

Haplothrips (*Chiraplothrips*) Priesner, 1930 : 271. Type-species *Haplothrips* (*Chiraplothrips*) *faureanus* Priesner, by monotypy.

Chiraplothrips Priesner; zur Strassen, 1960 : 347.

Priesner (1964*b*) provides a key to the three described species of *Chiraplothrips*. All of these apparently have the apical margin of the fore femora 'somewhat reflexed exteriorly'. This character is, however, difficult to observe and consequently I have avoided its use in the key above. Only one species of *Chiraplothrips* is recorded from India (Ananthakrishnan, 1969).

GENERIC DEFINITION. Medium sized brown to dark brown species of Haplothripini. Maxillary stylets long, when at rest retracted far into the head capsule; maxillary bridge present; post-ocular setae pointed. Antennal segment III with 0 + 1 sense cones, segment IV with 1 + 1 sense cones. Pronotal antero-marginal and mid-lateral setae vestigial; praepectal plates present. Macropterous, fore wings with duplicated cilia. Abdominal tergites III–VII each with two pairs of well developed wing-retaining setae.

Chiraplothrips graminellus (Priesner)

(Text-figs 35, 48)

Haplothrips (*Chiraplothrips*) *graminellus* Priesner, 1938 : 113–115. Syntypes ♀, ♂, CYPRUS: Cherkes, Asomotos; [LEBANON] Syria: Beirut; SUDAN: Wad Shair (SMF, BMNH) [1 ♀, 1 ♂ examined].

Haplothrips (*Chiraplothrips*) *priesneri* Ananthakrishnan, 1961*b* : 426–428. Holotype ♀, INDIA: Madras (LCM) [not examined]. [Synonymized by zur Strassen, 1968 : 100.]

Chiraplothrips graminellus (Priesner) Priesner, 1964*b* : 434.

Brown species; antennal segment III yellow; segments IV and V brownish yellow; segments VI–VIII pale brown; fore tibiae yellow, brown at base and margins; fore tarsi yellow; all femora and mid and hind tibiae brown; mid and hind tarsi pale brown.

Antennal segments III and IV with 0 + 1 and 1 + 1 sense cones respectively; post ocular setae pointed; pronotal antero-marginal and mid-lateral setae vestigial; fore wings with about 6–7 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

Priesner (1938) described *graminellus* from an unspecified number of females and males collected on turf and grasses in Cyprus, Lebanon and Sudan. I have examined two syntypes from Cyprus and these are both labelled 'Paratype'.

Ananthakrishnan (1961*b*) described *priesneri* from a holotype and an allotype collected on *Chloris barbata* (L.) Swartz at Madras, i. 1959 (*TNA*). I have not seen either of these specimens. Zur Strassen (1968) synonymized *priesneri* with *graminellus*.

SPECIMENS STUDIED.

Syntypes 1 ♀, 1 ♂, CYPRUS: Cherkes, turf, viii.1933 (*G. A. Mavroumoustakis*) (BMNH).

INDIA: Madras, 1 ♀ on grass, 11.vi.1963, 1 ♀ on grass, 11.vii.1963; Coimbatore, 3 ♀ on grass, 12.vi.1963; Tinnevelley, 1 ♀ on grass, 27.v.1965; (*TNA*) (BMNH).

HAPLOTHRIPS Amyot & Serville

Haplothrips Amyot & Serville, 1843 : 640. Type-species: *Phloeothrips albipennis* Burmeister [= *Thrips aculeata* Fabricius], by monotypy.

The genus *Haplothrips* has a world-wide distribution and comprises over 200 described species. The majority are flower-living although a number of predatory and mycophagous species have been recorded. Eleven of the 14 Indian species recognized here are flower-living. A further species originally described from galls has subsequently been recorded from flowers. The remaining two species are inquilines, one of psyllid galls and the other of galls and lepidopterous leaf-mines.

GENERIC DEFINITION. Medium sized, usually brown Haplothripini, rarely yellow or bicoloured. Maxillary stylets usually long and retracted far into the head capsule; maxillary bridge usually present. Post-ocular setae pointed, blunt, or expanded. Antennal segment III with at most 1 + 1 sense cones; antennal segment IV with $2 + 2^{+1}$ or more rarely 2 + 2 sense cones. Pronotal antero-marginal and mid-lateral setae vestigial to well developed; praepectal plates well developed. Usually macropterous, fore wings with or without duplicated cilia. Abdominal tergites III–VII usually with two pairs, rarely one pair, of well developed wing-retaining setae.

Subgenus ***HAPLOTHRIPS*** Amyot & Serville

Haplothrips Amyot & Serville, 1843 : 640.

The subgenus *Haplothrips* is used for species with duplicated cilia on the distal osterior margin of the fore wing.

Haplothrips (Haplothrips) andresi Priesner

(Text-fig. 38)

Haplothrips andresi Priesner, 1930 : 270–271. Syntypes ♀, ♂, EGYPT: Mersa, Matrouh (SMF; BMNH) [1 ♀ examined].

Haplothrips andresi Priesner; Ananthakrishnan & Jagadish, 1966 : 257.

Dark brown to black species with fore tibiae yellow towards apex, outer margins dark; mid and hind tibiae pale yellow at apex; all tarsi yellow; antennal segment III yellow, segments IV, V and VI pale in basal two-thirds; segment VII pale in basal third or more.

Antennal segments III and IV with $0 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae pointed apically; pronotal antero-marginal and mid-lateral setae well developed; fore wings with 10–12 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from an unspecified number of males and females collected in Egypt from grass and vine leaves or inside fig fruits, 12.vi.1930 (*A. Andres*) (Priesner, 1930). No holotype was designated although the single female syntype I have examined is labelled 'Paratype'. There is a female labelled as a paratype in the SMF (pers. com. L. A. Mound), but the number and whereabouts of the remaining syntypes are unknown to me.

Priesner (1964*b*) recorded *andresi* from the flowers of *Thymelaea hirsuta* (L.) Endlicher [Thymelaeaceae] in the north of Egypt. The species is also recorded from Palestine (Rivnay, 1933; Priesner, 1936) and southern India (Ananthakrishnan & Jagadish, 1966). Two Indian females identified by Professor Ananthakrishnan as *andresi* have been examined during the course of this study and these represent *tenuipennis* Bagnall. I have not seen Indian material of *andresi*

SPECIMENS STUDIED.

Syntype ♀, EGYPT: Mersa, Matrouh, in fig fruits, 12.vi.1930 (*A. Andres*) (BMNH).

Haplothrips* (*Haplothrips*) *bagrolis Bhatti

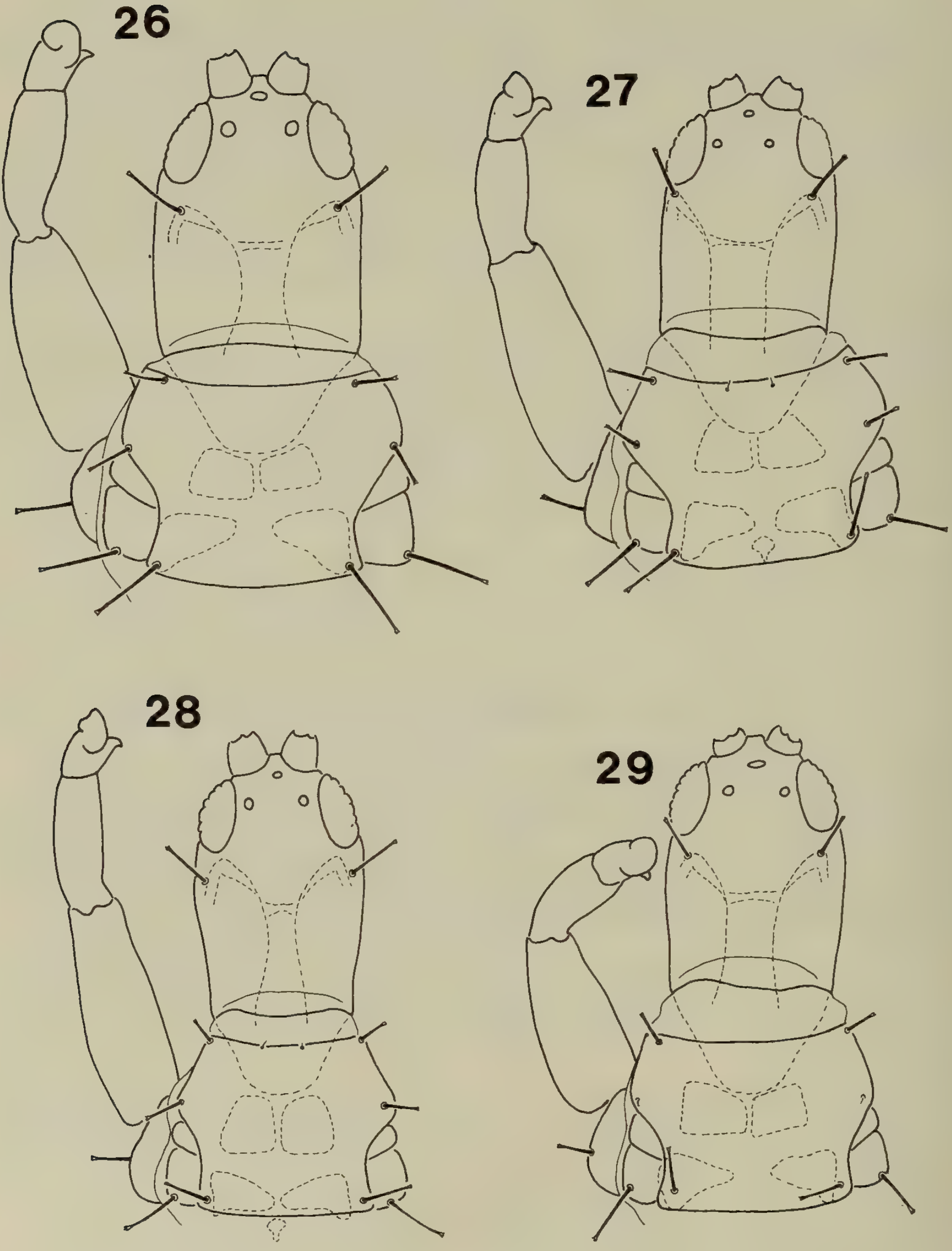
Haplothrips bagrolis Bhatti, 1973 : 535–537. Holotype ♂, INDIA: Himachal Pradesh, Bagrol, Kangra District (Hans Raj College, Delhi) [not examined].

Brown species; antennal segment III pale yellowish; segments IV–VI light brown; fore tibiae brown on outer margin; tarsi yellow.

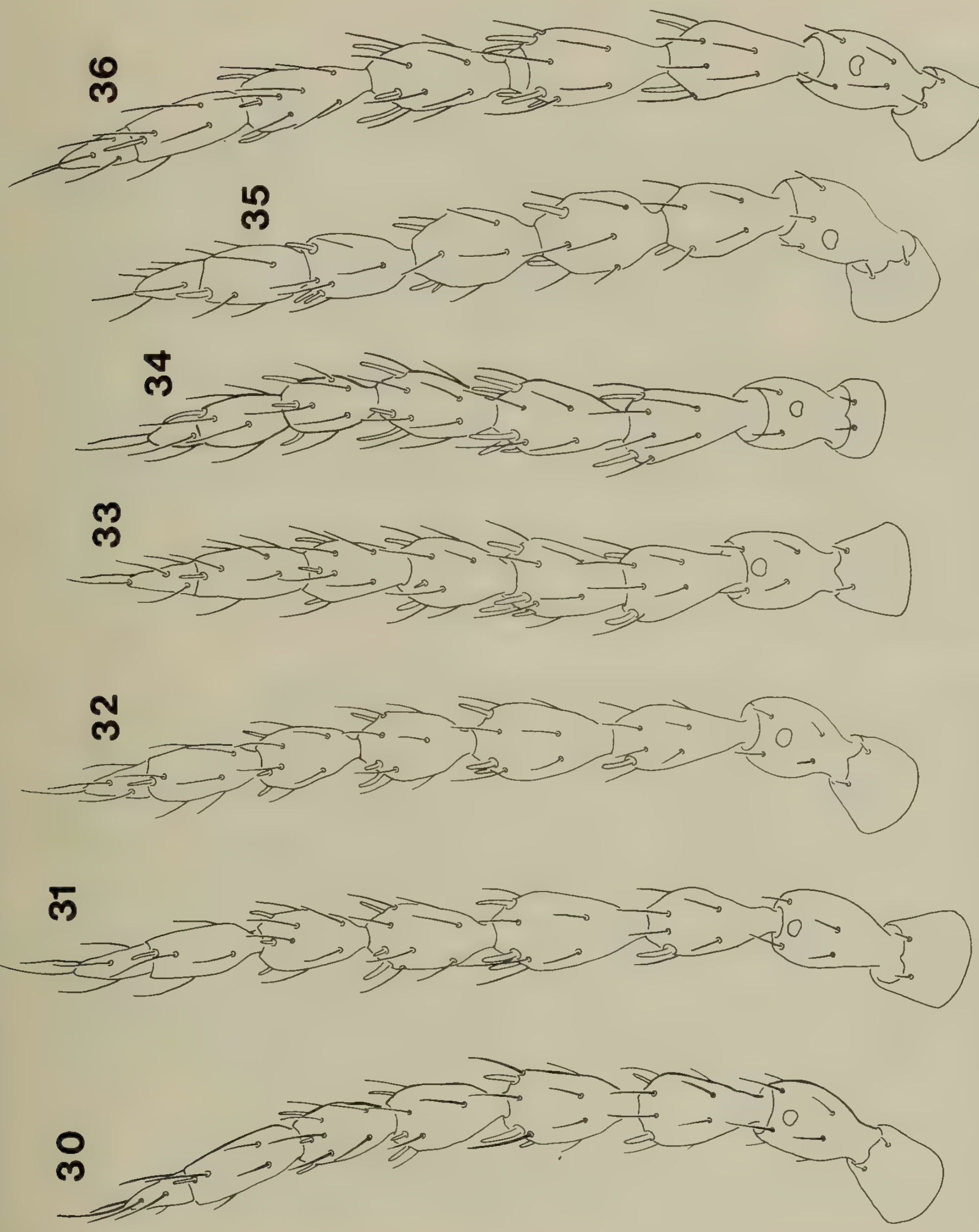
Antennal segments III and IV with $0 + 1$ and $2 + 2$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae fairly well developed and expanded apically; macropterous, fore wings with 5–9 duplicated cilia.

This species was described from a male holotype and an allotype and paratype female collected on wheat at Bagrol, Kangra District, 20.iii.1971 (*S. K. Ahluwalia*). I have not seen any of these specimens. The above diagnosis is drawn from the original description.

There are three males and four associated females from Pakistan in the BMNH which could represent this species, but I have not compared them with the type-material. One male and one associated female were collected on *Rubus* sp. [Rubiaceae] at Murree, 5.vi.1961; one male and three associated females were collected from *Plantago* [Plantaginaceae] flowers at Kwai, 14.v.1963; and one male was collected from the roots of an unidentified plant at Thapla, 15.x.1961. Apart from the bifid aedeagus of the males, these specimens are indistinguishable from *ganglbaueri* (cf. p. 249).



FIGS 26–29. *Karnyothrips* species: heads, pronota and left forelegs. 26, *alpha*, holotype ♀. 27, *flavipes*, ♀ (North American specimen). 28, *melaleucus*, ♀. 29, *nigriflavus*, paratype ♀.



FIGS 30–36. Antennae. 30–33, *Karnyothrips* species. 30, *melaleucus*, holotype ♀. 31, *alpha*, holotype ♀. 32, *nigriflavus*, paratype ♀. 33, *flavipes* ♀ (North American specimen). 34, *Haplothrips bicolor*, ♀. 35, *Chiraplothrips graminellus*, ♀. 36, *Haplothrips pirus*, syntype ♀.

Haplothrips* (*Haplothrips*) *bicolor (Ananthakrishnan) **comb. n.**

(Text-figs 34, 37)

Xylaplothrips bicolor Ananthakrishnan, 1964*a* : 53–54. Syntypes 2 ♀, 2 ♂, INDIA: Bapatla (LCM) [not examined].

Bicoloured species; head, thorax, posterior half and median third of abdominal segment VIII, abdominal segment IX and tube brown; abdominal segments II–VII yellow, segments III–VII each with a small median pale brown transverse patch near anterior margin; antennal segment I and much of segment II pale brown; antennal segments III–VI yellow; segments VII and VIII brown; all legs yellow except outer margin of fore femora which are tinged with brown.

Antennal segments III and IV with $1 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed; macropterous, fore wings with 5–6 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Ananthakrishnan (1964*a*) described *bicolor* from two females and two males collected on psyllid galls at Bapatla, 1952 (*TNA*). None of these specimens was designated as holotype and I have not examined any of them. The above diagnosis is based on the original description and a single female identified by Professor Ananthakrishnan.

SPECIMEN STUDIED.

INDIA: Courtallam, 1 ♀ on grass, 10.x.1964 (*TNA*) (LCM).

Haplothrips* (*Haplothrips*) *ceylonicus Schmutz

Haplothrips ceylonicus Schmutz, 1913 : 1038–1039. Syntypes ♀ ♂, SRI LANKA: Peradenya (presumed lost) [not examined].

Brown species; antennal segments III–VI yellow, segments VII and VIII brown; fore tibiae, apical half to one-third of mid and hind tibiae and all tarsi yellow.

Antennal segments III and IV with $0 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 6–9 duplicated cilia; median setae (B_1) on abdominal tergite IX slightly expanded apically.

Schmutz (1913) described *ceylonicus* from an unspecified number of females and males collected at Peradenya on *Cassipourea* sp. [Rhizophoraceae] and *Crotalaria striata* Candolle [Leguminosae] by Uzel. These are presumed lost. The above diagnosis is based on three females from India collected on *Ficus* [Moraceae] and identified by Dr J. S. Bhatti.

Priesner (1933*b*) redescribed *ceylonicus* from material collected in Java, Sumatra and Riouw Archipelago. I have examined some of these specimens, from Wai Lima, Lampongs, Sumatra. Contrary to the redescription these specimens have $1 + 1$ sense cones on antennal segment III and are identical with *tenuipennis* Bagnall.

I have also examined seven females from India (USNM) and one female from Sri Lanka (SMF) identified by Professor Ananthakrishnan and the late Professor Dr Priesner as *ceylonicus*. These are indistinguishable from *tenuipennis*.

SPECIMENS STUDIED.

INDIA: Madras, 3 ♀ on *Ficus* sp., viii.1973 (*J. S. Bhatti*) (Hans Raj College, Delhi).

Haplothrips* (*Haplothrips*) *ganglbaueri Schmutz

Haplothrips Ganglbaueri Schmutz, 1913 : 1034. Syntypes ♀, SRI LANKA: Peradenya (presumed lost) [not examined].

Haplothrips ceylonicus var. *vernoniae* Priesner, 1921 : 4. Syntypes 5 ♀, 1 ♂, JAVA: Semerang (4 ♀, 1 ♂ in SMF) [4 ♀, 1 ♂ examined]. **Syn. n.**

Zygothrips andhra Ramakrishna, 1928 : 290–291. Holotype ♀, INDIA: Guntur, Madras Presidency (Tamil Nadu University College, Coimbatore) [examined]. **Syn. n.**

Haplothrips priesnerianus Bagnall, 1933 : 327–328. Lectotype ♂, INDIA: Allahabad (BMNH), designated by Mound (1968 : 114) [examined]. **Syn. n.**

Brown species; antennal segments I and II brown; segment III brownish yellow; segments IV, V and VI successively darker; fore tibiae yellow with brown margins.

Antennal segments III and IV with $0 + 1$ and $2 + 2^{+1}$ sense cones respectively; post ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 5–8 duplicated cilia; median setae (B_1) on abdominal tergite IX blunt to slightly expanded.

Schmutz (1913) described *ganglbaueri* from an unspecified number of females collected at Peradenya, Sri Lanka on rice flowers by Uzel. These are presumed lost. Priesner (1921; 1933*b*) redescribed *ganglbaueri* from material of both sexes collected in Java, Sumatra and Krakatau. This material is indistinguishable from *priesnerianus*.

The variety *vernoniae* was described from five females and one male collected at Semerang, Java. I have examined four female and one male syntypes labelled 'COTYPE' and cannot distinguish them from the type-series of *priesnerianus*.

Zygothrips andhra was described from a unique female holotype collected at Guntur, Madras Presidency, India. I cannot distinguish this specimen from *priesnerianus* or *bagrolis*. Dr Bhatti (pers. com.), however, considers *andhra* as a synonym of *ganglbaueri*, a view I have accepted here.

Haplothrips priesnerianus was originally described from an unspecified number of females and males collected at Allahabad on flowers of *Lantana* [Verbenaceae], 26.iii.1910 (*A. D. Imms*). One of the males, which is labelled 'TYPE', was designated as the lectotype by Mound (1968) and is deposited in the BMNH with two females and two males regarded as paralectotypes. The above synonymy is based on comparison of the original description of *ganglbaueri* (Schmutz, 1913), Priesner's redescriptions (Priesner, 1921; 1933*b*), the lectotype and paralectotypes of *priesnerianus* and numerous specimens from India identified by Professor Ananthakrishnan and Dr Bhatti as *ganglbaueri*.

Bhatti (1973) distinguished *ganglbaueri* from *bagrolis* on the metanotal sculpture, the length of the pronotal postero-angular setae and the shape of antennal segment III and the male aedeagus. Apart from the shape of the male aedeagus these characters vary from one specimen of *ganglbaueri* to another and are here considered unreliable. I have not found any characters which could be used to distinguish females of *bagrolis* and *ganglbaueri*. The females referred to below under

'Specimens studied' have been identified by association with males of *ganglbaueri*. The unassociated females that I have examined are listed separately. These could represent either *ganglbaueri* or *bagrolis*.

Specimens studied.

Syntypes 4 ♀, 1 ♂ of *ceylonicus* var. *vernoniae*, Java: Semerang, 'aus Blümen und verkruppelten, teilweise gerolten Blättern von *Vernonia cinerea*', 3.vii.1912 (*W. Docters v. Leeuwen*) (SMF). Holotype ♀ of *andhra*, India: Guntur, Madras Presidency, on cholam shoots (*T. V. Ramakrishna* No 152) (Tamil Nadu University College, Coimbatore). Lectotype ♂, paralectotypes 3 ♀, 2 ♂ of *priesnerianus*, India: Allahabad, flowers of *Lantana* in jungle, 26.iii.1920 (*A. D. Imms*) (BMNH).

India: Annamalais, 1 ♀, 3 ♂ on grass, 26.ix.1965; Bangalore, 2 ♀, 1 ♂ on grass, 20.iv.1964; Kodaikanal, 1 ♂ on grass, 25.v.1965; Valparai, 1 ♀, 1 ♂ on grass, 26.ix.1965 (*TNA*) (USNM); Rajasthan, Udaipur, 7 ♀, 5 ♂, 4.xi.1964 (*CIE*) (BMNH). Pakistan: Muree, 31 ♀, 7 ♂ on *Arundinella nepalensis* Trinius, 16 ♀, 2 ♂ on *Cymbopogon martini* (Roxburgh) Watson, 5.vi.1961 (*CIE*); Nowsera, 1 ♀, 1 ♂ on *Tagetes africana*, 3.i.1964 (*CIE*); Peshawar, 9 ♀, 4 ♂ on *Pennisetum typhoideum* L. Richard, 30.ix.1964; (BMNH). Bangladesh: Dacca, 1 ♀, 1 ♂ on wheat, iv.1969 (*Agric. Res. Inst.*); Ishardi 6 ♀, 1 ♂ on Chinese paddy, 4.v.1968 (*Ma Hasib Plant Quarantine St.*); (BMNH). Solomon Is.: Guadalcanal, 27 ♀, 9 ♂, on rice, xi–xii.1965 (*M. McQuillan*); Guadalcanal, Kukum Agric. St., 1 ♀, 1 ♂ on grass and flowers, 21.x.1965 (*P. N. Lawrence*); (BMNH).

Unassociated females of *ganglbaueri* or *bagrolis*.

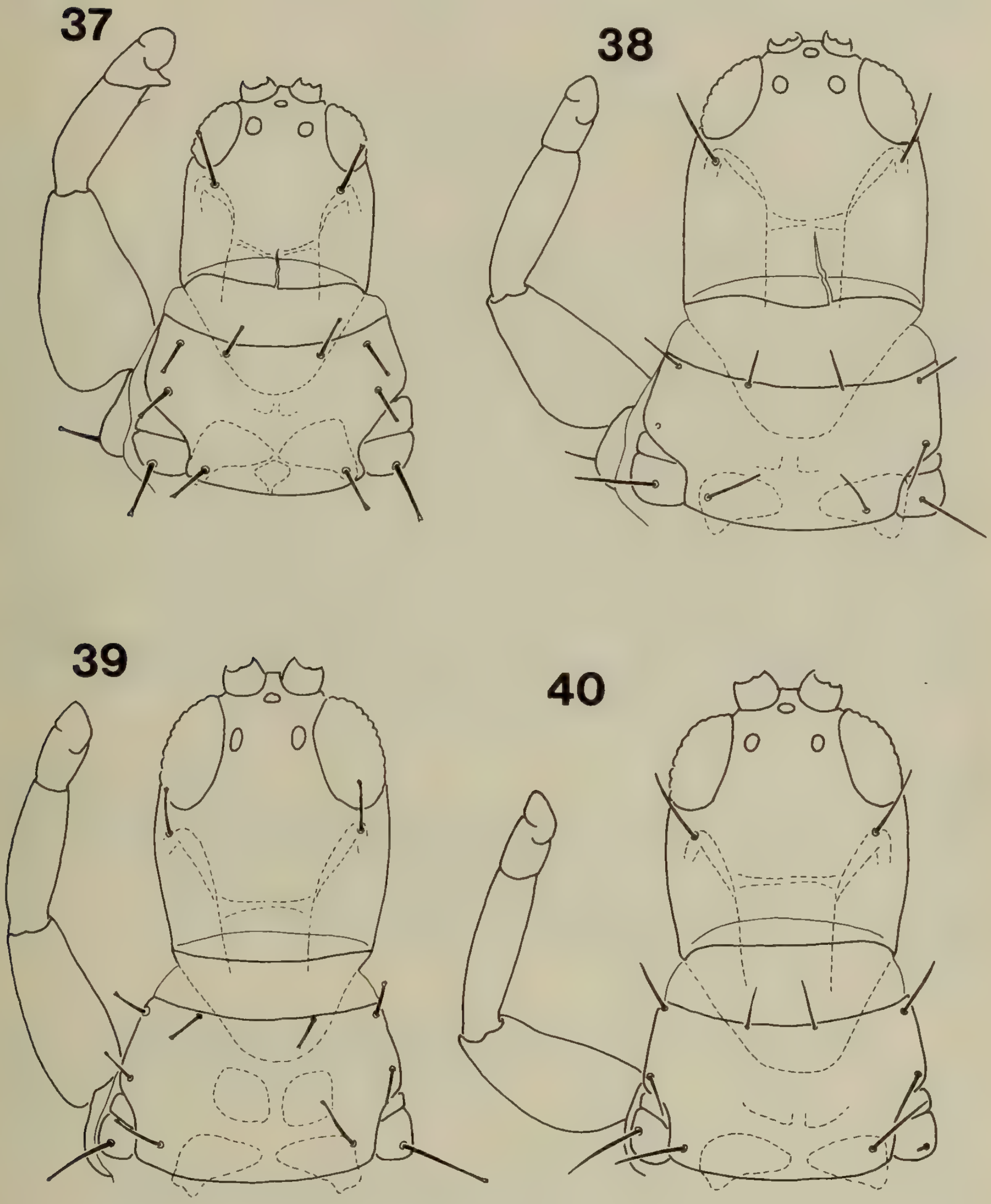
India: Rawalpindi, 9 ♀ on *Cymbopogon distans* (Nees) W. Watson, 11.vii.1960 (*CIE*); Indore, 1 ♀ on *Sorghum vulgare* Persoon, 1.x.1966 (Coll. Agric.); Madras, 3 ♀ on grass, 17.iv.1963 (*TNA*); Mussoorie, 1 ♀ on fern, 13.vi.1967 (*TNA*); New Delhi, 1 ♀ on grass 10.viii.1966 (*TNA*) (BMNH; USNM). Pakistan: Lyallpur, 4 ♀ on wheat, 26.v.1968 (*Ayub Agric. Res. Inst.*) (BMNH). Bangladesh: Dacca, 4 ♀ on rice, 15.ii.1966 (CIBC); Dacca, 2 ♀ on water hyacinth, 1961 (*Govt. Entomologist*) (BMNH). Java: Buitzenzorg, Medan S.O.K., 1 ♀ on *Imperator exaltata* (Roxburgh) Brongniart (*L. Fulmek*) (BMNH). Solomon Is.: Guadalcanal, 11 ♀ on ?*Brachiaria mutica* (Forsskal) Stapf, 17.v.1966 (*M. McQuillan*); Guadalcanal, Papananism, 1 ♀ Oct. 1965 (*P. Greenslade*) (BMNH). Philippines: Alicia Isabella, 1 ♀ on rice seedlings, 26.v.1972 (*A. D. Pawar*) Los Banos, I.R.R.I. Lagina, 1 ♀ on rice panicles, 20.xii.1971 (*A. D. Pawar*) (BMNH).

Haplothrips* (*Haplothrips*) *gowdeyi (Franklin)

(Text-fig. 39)

Anthothrips gowdeyi Franklin, 1908 : 724. Syntypes 31 ♀, Barbados (10 ♀ in USNM; 21 ♀ in Massachusetts Agricultural College) [not examined].

Haplothrips sororcula Schmutz, 1913 : 1036–1037. Syntypes ♀, ♂, Sri Lanka : Peradenya (1 ♀ in SMF; depository of remainder unknown) [1 ♀ examined]. **Syn. n.**



Figs 37–40. *Haplothrips* species: heads, pronota and left forelegs. 37, *bicolor*, ♀. 38, *andresi*, paratype ♀ (Egyptian specimen). 39, *gowdeyi*, ♀ (African specimen). 40, *reuteri*, ♀ (European specimen).

Haplothrips soror Schmutz, 1913 : 1036–1037. Syntypes ♀, ♂, Sri Lanka: Peradenya (2 ♀ in SMF; depository of remainder unknown) [2 ♀ examined]. **Syn. n.**
Haplothrips gowdeyi (Franklin) Watson, 1921 : 38.

Brown species; antennal segments III–V yellow; segment IV yellow-brown; segments VII and VIII brown; mid and hind tibiae brown; all tarsi pale brown.

Antennal segments III and IV with 1 + 1 and 2 + 2 $^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 4–9 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

Schmutz (1913) described *sororcula* from an unspecified number of females and males collected on 'Blättern des Zimtbaumes und in *Canna*-Blüten' and 'Blüten von *Crotalaria striata* D.C. und in Reis'; and *soror* from an unspecified number of females and males on 'Bluten von ? ? an den Ufern des Maveli' and 'Blattern vom Zimtbaum'. As pointed out above, male syntypes of *sororcula* were collected with female syntypes of *ceylonicus* Schmutz; and male syntypes of *soror* were collected with female syntypes of *ganglbaueri* Schmutz. Fortunately, however, some female syntypes of *sororcula* and *soror*, labelled as 'Cotype' and 'Cotypen' respectively, are deposited in the SMF. I have examined these and cannot distinguish them from *gowdeyi*. The number and whereabouts of the remaining syntypes is unknown to me.

Haplothrips gowdeyi is a pantropical species breeding in the flowers of Gramineae. It may, however, be frequently collected in the flowers and on the foliage of numerous other plant families. The female examined from Madras on *Amaranthus* had been misidentified as *ramakrishnai* Karny (= *nigricornis* Bagnall); and the two females from Madras on grass as *coloratus* Trybom.

Specimens studied.

Syntypes 2 ♀ of *soror*, Sri Lanka (Ceylon): Mahaveli (*Uzel*) (SMF). Syntype ♀ of *sororcula*, Sri Lanka (Ceylon): Peradenya, auf Zimtbaum (*Uzel*) (SMF).

India: Conjeeveram, 4 ♀ on grass, 1.vi.1963; Kodaikanal, 1 ♀ on grass, 12.vi.1963; Udaipur, 1 ♀ on wild flowers, 30.v.1966; Madras, 1 ♀ on *Amaranthus*, 22.vi.1963; Tambaram, 1 ♀, 20.iv.1963; Pollachi, 1 ♀ on *Eleusine*, 10.vi.1963; Madras, 2 ♀ on grass, 18.vii.1965; (*TNA*) (USNM).

Haplothrips* (*Haplothrips*) *longisetosus Ananthakrishnan

Haplothrips longisetosus Ananthakrishnan, 1955 : 610–611. Syntypes 2 ♀, India: Malabar (LCM) [not examined].

This species was originally described from two females collected at Malabar from wild flowers. No holotype was designated in the original description and I have not studied either specimen. According to the original description and its accompanying figure antennal segment III has four sense cones and antennal segment IV has two sense cones. If this is correct then *longisetosus* does not belong in *Haplothrips* or any of the related genera discussed in this account. However, if this statement and the figure are the result of an error, as is suggested by the reference 'antennae as in *H. gowdeyi*', then *longisetosus* is similar to *gowdeyi* and *tenuipennis*. The 'considerably longer' major setae distinguish *longisetosus* from both of these species.

Haplothrips* (*Haplothrips*) *pirus Bhatti

(Text-fig. 36)

Haplothrips pirus Bhatti, 1967 : 23. Syntypes ♀, ♂, INDIA: New Delhi (Hans Raj College, Delhi) [1 ♀, 1 ♂ examined].

Yellow species with tube dark brown in slightly less than distal two-thirds; antennal segment V brown in distal half; segment VI brown in slightly less than distal two-thirds; segments VII and VIII dark brown.

Antennal segments III and IV with 1 + 1 and $2 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed; macropterous, fore wings with 4–6 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

This species was described from an unspecified number of males and females collected from small brownish leaf-galls and from lepidopterous leaf-mines of *Syzigium*, 21.vi.1966 and 25.ix.1966, New Delhi (*J. S. Bhatti*). I have examined a female and male syntype labelled 'PARATYPE' and 'ALLOTYPE' respectively. Contrary to the original description 'antennal seg. 2' does not have '2 sense cones'; and antennal segment '3' does not have '4 sense cones'. I assume that Bhatti confused antennal segment III and IV with II and III. In fact segment II only has the characteristic companiform sensilla (see Heming, 1975) and segment III has 1 + 1 sense cones and segment IV has $2 + 2^{+1}$ sense cones.

SPECIMENS STUDIED.

Syntypes 1 ♀, 1 ♂, INDIA: New Delhi, leaf mines of Jamun (*Syzygium*) 21.vi.1966 25.ix.1966 (*J. S. Bhatti*) (Hans Raj College, Delhi).

Haplothrips* (*Haplothrips*) *reuteri Karny

(Text-fig. 40)

Anthemothrips reuteri Karny, 1907 : 51. Syntypes, [?YUGOSLAVIA] 'Österreich-Ungarn': Karlopago [?Karlobag] (depository unknown) [not examined].

Haplothrips reuteri (Karny) Priesner, 1921 : 14.

Haplothrips reuteri (Karny); Moulton, 1929 : 4.

Haplothrips tenuisetosus Bagnall, 1933 : 320–321 [examined]. [Synonymised by Priesner, 1964 : 151.]

Haplothrips satanus Bagnall, 1933 : 321–323 [examined]. [Synonymised by Priesner, 1964: 151.]

Brown species with antennae brown, segment III slightly paler than segment II; fore tibiae paler towards apex: fore tarsi yellow-brown.

Antennal segments III and IV with 1 + 1 and $2 + 2^{+1}$ sense cones respectively; post-ocular setae pointed; pronotal antero-marginal and mid-lateral setae well developed and pointed; macropterous, fore wings with 4–8 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

Karny (1907) described *reuteri* from an unspecified number of specimens collected at Karlopago in flowers of *Knautia* sp. [Dipsaceae] 26.vii.1905. The original description does not make it clear whether these specimens included females as well as males. The above diagnosis is based on the examination of the holotype females of *satanus* Bagnall and *tenuisetosus* Bagnall, synonymised with *reuteri* by Priesner (1964).

The only published record of *reuteri* in India appears to be that of Moulton (1929). I have examined 14 of the 20 males and females on which this record is based.

SPECIMENS STUDIED.

Holotype ♀ of *satanus*, FRANCE: Perpignan, on *Centaurea solstitialis* L., viii.1926 (*R. S. Bagnall*) (BMNH). Holotype ♀ of *tenuisetosus*, SUDAN: Wad Medani, *Dolichos lablab* L., 7.iv.1932 (*A. P. G. Michelmore*) (BMNH).

INDIA: Dehra Dun, 9 ♀, 5 ♂ (*J. C. M. Gardner*) (CAS).

Haplothrips* (*Haplothrips*) *tenuipennis Bagnall

(Text-fig. 42)

Haplothrips tenuipennis Bagnall, 1918 : 210. Lectotype ♂, INDIA: Darjeeling District, Rington (BMNH), designated by Mound (1968 : 118) [examined].

Haplothrips ceylonicus var. *mangiferae* Priesner, 1933*b* : 359. Syntypes ♀♂, JAVA: Semarang (SMF) [not examined]. [Synonymized by Mound, 1968 : 118.]

Brown species with antennal segments III–VI yellow, segments IV–VI slightly tinged with brown at apex; segment II paler towards apex; segments VII and VIII pale brown; fore tibiae and all tarsi yellow.

Antennal segments III and IV with $1 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 6–10 duplicated cilia; median setae (B_1) on abdominal tergite IX blunt to slightly expanded.

Bagnall (1918) described *tenuipennis* from an unspecified number of males and females collected on rose and tea bushes. There are a total of eleven females and six males in the BMNH all bearing type data. Of these one female and one male are labelled 'Type' and one female and three males are labelled 'Cotype'. The remaining nine females and two males are not labelled as type-material but are here assumed to be some of Bagnall's syntypes. The male labelled 'Type' was designated as the lectotype by Mound (1968), the remaining 11 females and five males are regarded here as paralectotypes.

Haplothrips ceylonicus var. *mangiferae* was originally described from '♀♀♂, Semarang, Java; 25–VIII–1912, in Bluten von *Mangifera indica* L., leg Docters van Leeuwen.' Some of these syntypes are labelled as cotypes and Mound (1968) refers to these incorrectly as paratypes.

All of the specimens in the USNM of *tenuipennis* had been misidentified by Professor Ananthakrishnan as follows: from Bhopal on *Polygonum*, Madras on *Zizyphus*, and Trichur and Tambaram on grass as *ceylonicus*; from Madras on grass as *ganglbaueri* and *coloratus*; from Valparai on tea as *andresi*; and from Poona on Mango as *mangiferae*.

SPECIMENS STUDIED.

Lectotype ♂, paralectotypes 11 ♀, 5 ♂, INDIA: Darjeeling District, Rington T. E. on rose and tea bushes, 14.vi.1916 (*E. A. Andrews*) (BMNH).

INDIA: Bhopal, 1 ♀ on *Polygonum* infl. 18.x.1966; Madras, 1 ♀ on grass, 17.iv.1963; Madras, 4 ♀ on *Zizyphus* fl., 12.vi.1963; Poona, 7 ♀, 1 ♂ on Mango infl., 23.i.1965; Trichur, 1 ♀ on grass, 6.x.1963; Tamboram, 1 ♀ on grass, 20.iv.1963; Valparai, 2 ♀ on tea fl., 26.ix.1965; (*TNA*) (USNM); Indore, 7 ♀, 2 ♂ on *Mangifera indica* L., 1 ♀, 1 ♂ on *Phaseolus lunatus* L., 1 ♀, 1 ♂ on *Dolichos* lablab L. fl. 14.iii.1967 (*Coll. Agric.*); Assam, Darjeeling, 8 ♀, 1 ♂ on tea shoots, 1965 (*Toklai Expt. St.*); Udaipur, 1 ♀ on flowering plant, 11.v.1966 (*Udaipur Univ.*); (BMNH).

Subgenus ***TRYBOMIELLA*** Bagnall

Trybomiella Bagnall, 1926 : 548. Type-species: *Haplothrips bagnalli* Trybom, by original designation.

The subgenus *Trybomiella* is used for species of *Haplothrips* without duplicated cilia on the distal posterior margin of the fore wing.

Haplothrips (Trybomiella) apicalis Bagnall

(Text-figs 9, 17, 24)

Hindsiana apicalis Bagnall, 1915 : 323. Lectotype ♀ microptera, INDIA: Almora, Kumaon, (BMNH), designated by Mound (1968 : 109) [examined].
Haplothrips (*Hindsiana*) *apicalis* (Bagnall) Priesner, 1933*b* : 361–363.
Haplothrips (*Trybomiella*) *apicalis* (Bagnall); Ananthakrishnan, 1962 : 473–475.
Haplothrips (*Trybomiella*) *apicalis* (Bagnall); Ananthakrishnan, 1969 : 138.

Bicoloured species; head, antennal segments I, II and VI–VIII, pterothorax, anterior third of abdominal segments II–VII, abdominal segments VIII–X, and mid and hind tibiae brown; prothorax, fore legs and mid and hind femora yellow-brown; remainder yellow.

Antennal segments III and IV with $0 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; micropterous, brachypterous, or macropterous, fore wings, even when fully developed, without duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

Bagnall (1915) described *apicalis* from 'several specimens swept from a jungle plant' at Almora, India. The micropterous lectotype female and a second micropterous female, assumed to be a paralectotype, are in the BMNH. The number and whereabouts of the remaining specimens of the type-series are unknown to me.

Unlike other species of the genus, *apicalis* has only one pair of well developed wing-retaining setae on each of abdominal tergites III–VII. The fore wings, even when fully developed, lack duplicated cilia, as do species of the subgenus *Trybomiella*. However, *apicalis* is not closely related to these species and is being

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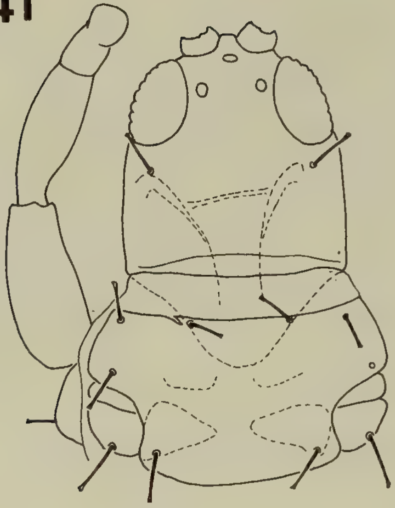

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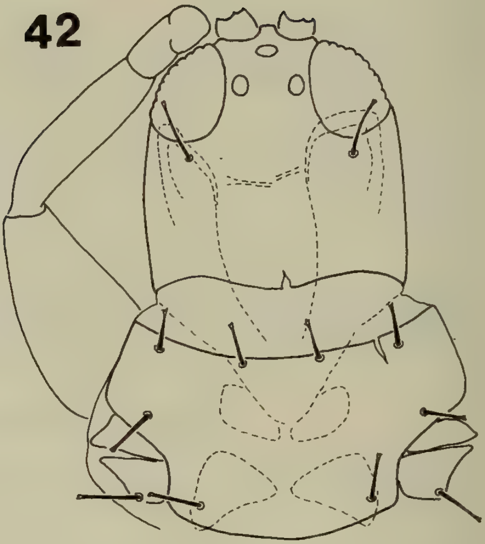

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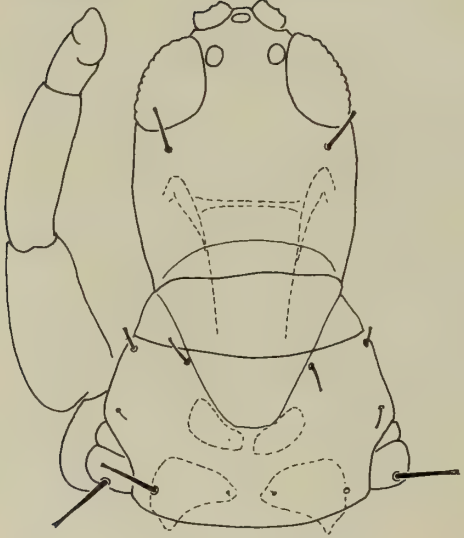
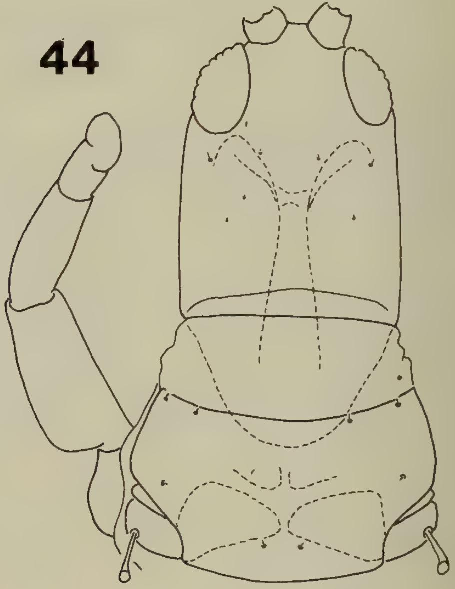


44



FIGS 41–44. *Haplothrips* species: heads, pronota and left forelegs. 41, *ganglbaueri* (lectotype ♀ of *priesnerianus*). 42, *tenuipennis*, lectotype ♀. 43, *articulosus*, ♀ (African specimen). 44, *euphorbiae*, paratype ♀.

transferred elsewhere to a new genus by Dr Bhatti (pers. comm.). The reduction of the wing-retaining setae and absence of duplicated cilia may be associated with the grass-living habit.

This species is recorded from Java (Priesner, 1933*b*) and India (Ananthakrishnan, 1969). I have studied specimens from India and Pakistan.

SPECIMENS STUDIED.

Lectotype ♀ microptera, paralectotype ♀ microptera, INDIA: Almora, Kumaon, on a jungle plant, 4.vii.1911 (*O. Paiva*) (BMNH).

INDIA: Madras, 2 ♀ micropterae, 2 ♀ macropterae (wings lost), 3 ♂ micropterae on *Cynodon* [Gramineae], 21.v.1963 (*TNA*) (BMNH; USNM); Poona, 1 ♀ microptera, 2 ♂ macropterae on grass, 23.i.1965 (*TNA*) (USNM); Surat, 1 ♂ macroptera on grass, 28.x.1965 (*TNA*) (USNM); 7 ♀ micropterae, no further data, Bagnall Reg. 163 (BMNH). PAKISTAN: Taimergarha, 1 ♀ microptera, 30.i.1964 (*CIBC*) (BMNH).

Haplothrips* (*Trybomiella*) *articulosus Bagnall

(Text-fig. 43)

Anthothrips bagnalli var. *pallicornis* Trybom, 1911 : 10. Syntypes ♀, ♂, KENYA: Mombasa (Riksmuseum, Stockholm) [not examined].

Haplothrips articulosus Bagnall, 1926 : 548–549. Holotype ♀, TANZANIA: Morogoro (BMNH) [examined].

Haplothrips trybomianus Priesner, 1927 : 70. Replacement name for *bagnalli* var. *pallicornis* Trybom. [Synonymized by Mound, 1968 : 109.]

Haplothrips (*Trybomiella*) *derisor* Priesner, 1935 : 324. Holotype ♀, SIERRA LEONE [examined]. [Synonymized by Mound, 1968 : 109.]

Brown species; antennal segments III–VI brownish yellow, segments VII–VIII pale brown; apex of fore tibiae and fore tarsi brownish yellow; mid and hind tibiae brown; mid and hind tarsi pale brown.

Antennal segments III and IV with $1 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae slightly expanded apically; pronotal antero-marginal and mid-lateral setae well developed and slightly expanded apically; macropterous, fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX slightly expanded apically.

Bagnall (1926) described *articulosus* from an unspecified number of specimens of both sexes. There are a total of two females and five males in the BMNH including the holotype female and these are labelled either 'TYPE' or 'COTYPE'.

Ananthakrishnan (1969) lists *articulosus* as occurring in India although I know of no published records of this species outside the African continent. There are, however, two females in the USNM from Hyderabad, India which I cannot distinguish from *articulosus*.

SPECIMENS STUDIED.

Holotype ♀, paratypes 1 ♀, 5 ♂ of *articulosus*, TANZANIA: Morogoro, sunflower blossom, 9.i.1925 (*A. H. Ritchie*) (BMNH). Holotype ♀, paratypes 5 ♀, 1 ♂ of *derisor*, SIERRA LEONE: *Erigeron sumatrensis* Retzius leaves (*E. Hargreaves*) (BMNH). INDIA: Hyderabad, 2 ♀ on grass, 25.vi.1964 (*TNA*) (USNM).

Haplothrips (Trybomiella) bagnalli (Trybom)

Anthothrips bagnalli Trybom, 1910 : 65. Syntypes 374 ♀, 105 ♂, SOUTH AFRICA; SOUTH WEST AFRICA; BOTSWANA (SMF; ?Riksmuseum, Stockholm) [13 ♀, 9 ♂ ?Syntypes examined].
Haplothrips bagnalli (Trybom) Karny, 1912 : 325.
Haplothrips bagnalli (Trybom); Faure, 1955 : 219.

Brown species; antennal segment III slightly paler than segment II; fore tibiae yellow brown medially and towards apex; fore tarsi greyish yellow; mid and hind tibiae and tarsi brown.

Antennal segments III and IV with 1 + 1 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae vestigial; macropterous, fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX blunt or slightly expanded.

Ananthakrishnan (1969) lists *bagnalli* as occurring in India although I know of no published records outside southern Africa. I have not seen any specimens of *bagnalli* from India. Four Indian specimens identified as *bagnalli* by Professor Ananthakrishnan have been examined. These specimens, from Tambaram on grass, could not be distinguished from the closely related species, *nigricornis* Bagnall.

SPECIMENS STUDIED.

?Syntypes 13 ♀, 9 ♂, SOUTH AFRICA (*L. Schultze*) (SMF).

Haplothrips (Trybomiella) clarisetis Priesner

Haplothrips clarisetis Priesner, 1930 : 237–238. Syntypes 4 ♀, SOUTH AFRICA & EGYPT: (SMF) [not examined].
Haplothrips clarisetis Priesner; Faure, 1955 : 223–230.

Brown species; antennal segment III yellow-brown, paler than segment II; segment IV slightly darker than III, nearly as dark as V; segments V–VIII brown; apex of fore tibiae and tarsi brownish yellow; mid and hind tarsi pale brown.

Antennal segments III and IV with 1 + 1 and 2 + 2^{+1} sense cones respectively; post-ocular setae slightly expanded apically; pronotal antero-marginal setae well developed and slightly expanded apically, mid-lateral setae vestigial; macropterous, fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from one female collected at Rosslyn, Pretoria, on cabbage, 25.iii.1919 (*J. C. Faure*); one female at White River, Transvaal on lemons, 27.viii.1926; and two females at Orman Gardens, Cairo on *Chenopodium* sp. (*H. Priesner*). I have not seen any of these specimens. The above diagnosis is based on the excellent redescription given by Faure (1955) and material in the BMNH from South Africa, Angola, Egypt, Israel and Palestine. At present I am unable to distinguish *clarisetis* from the Australian species *robustus* Bagnall.

The Indian material in the USNM that I have examined had been misidentified by Professor Ananthakrishnan as follows: from Bareilly on *Celosia*, and Madras and Tambaram on grass as *nigricornis*; and from Baroda and Madras on *Amaranthus*, and Coonoor on bamboo as *ramakrishnai*.

Specimens studied.

India: Bareilly, 1 ♀ on *Celosia*, 3.viii.1966; Baroda, 4 ♀, on *Amaranthus*, 26.x.1965; Coonoor, 1 ♀ on bamboo sheath, 8.vi.1963; Madras, 2 ♀, 1 ♂ on *Amaranthus*, 22.iv.1963; 2 ♀ on grass, 22.i.1964; Metupaleyam, 1 ♀, 1 ♂, on *Celosia*, 23.ii.1966; Tambaram, 1 ♀, 8.viii.1966; (*TNA*) (USNM).

Haplothrips* (*Trybomiella*) *euphorbiae Priesner

(Text-fig. 44)

Haplothrips (?) *euphorbiae* Priesner, 1931 : 1–4. Holotype ♀, Sumatra: Medan (SMF) [examined].

Haplothrips euphorbiae Priesner; Priesner, 1933*b* : 347.

Brown species; apex of fore tibiae and fore tarsi greyish yellow.

Antennal segments III and IV with 1 + 1 and $2 + 2^{+1}$ sense cones respectively; post-ocular setae reduced; pronotal antero-marginal and mid-lateral setae vestigial; macropterous, fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Priesner (1931) described *euphorbiae* from an unspecified number of females and males, including a type female, collected on galls on *Euphorbia hirta* at Medan, Sumatra. I have examined the holotype and three paratype females plus further material from Sumatra and India. The three Indian specimens from Waltair on grass in the USNM had been misidentified by Professor Ananthakrishnan as *talpa* Priesner.

Specimens studied.

Holotype ♀, paratypes 3 ♀, Sumatra: Medan, on *Euphorbia hirta* L., v.1931 (*L. Fulmek*) (SMF).

Sumatra: Medan, S. O. K., 2 ♀ on *Euphorbia hirta* L., xii.1923 (*L. Fulmek*) (BMNH). India: Anand, 4 ♀, 1 ♂ on *Euphorbia* fls, 27.x.1965; Waltair, 3 ♀ on grass, 20.ix.1964; (*TNA*) (USNM).

Haplothrips* (*Trybomiella*) *nigricornis (Bagnall)

Anthothrips nigricornis Bagnall, 1910 : 425–426. Syntypes 12 ♀, 3 ♂, South Africa: Cape Town (BMNH) [examined].

Haplothrips ramakrishnai Karny, 1926 : 218. Holotype ♀, India: Coimbatore (SMF) [examined]. **Syn. n.**

Haplothrips nigricornis (Bagnall); Faure, 1955 : 208–218.

Brown species; antennal segment III slightly paler than segment IV, segments IV–VIII slightly paler than segments I and II; apex of fore tibiae and fore tarsi yellow-brown.

Antennal segments III and IV with 1 + 1 and $2 + 2^{+1}$ sense cones respectively; post ocular setae slightly expanded apically; pronotal antero-marginal and mid-lateral setae vestigial; macropterous fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX pointed or blunt.

Bagnall described *nigricornis* from 'numerous specimens' of both sexes collected in South Africa on flowers of *Diplopappus*, *Europs*, *Olipterus* and *Sebaea*. There are twelve females and three males in the BMNH mounted on two slides. One slide is labelled 'TYPES' and the other 'COTYPES'. The only other data on the slides are 'S. AFRICA/R. S. BAGNALL' and 'TUBULIFERA/*Haplothrips nigricornis* Bagn./♀♀♂♂' and 'Bagnall Coll./B.M. Reg. No. 1932–339'.

Karny (1926) described *ramakrishnai* from a unique female collected inside *Chrysanthemum* flowers, 13.viii.1918 (*Ramakrishna*). I have compared this and four other Indian specimens with the syntypes of *nigricornis* and further material from South Africa, Angola, Rhodesia, Tanzania, Uganda and Ethiopia in the BMNH. The Indian specimens had been misidentified by Professor Ananthakrishnan as *bagnalli*.

SPECIMENS STUDIED.

Syntypes 12 ♀, 3 ♂ of *nigricornis*, SOUTH AFRICA (BMNH). Holotype ♀ of *ramakrishnai*, INDIA: Coimbatore, *Chrysanthemum* flowers, 3.vii.1918 (*Ramakrishna*) (SMF).

INDIA: Tambaram, 4 ♀ on grass, 29.iv.1965 (*TNA*) (USNM).

Haplothrips (Trybomiella) talpa Priesner

Haplothrips talpa Priesner, 1930 : 243. Syntypes ♀, ♂, SOUTH AFRICA: Transvaal, Potgietersrust (depository unknown) [not examined].

Body brown; antennal segment III yellow-brown, segments IV–VI slightly darker than III but paler than VII and VIII; fore tarsi and sometimes apex of fore tibiae yellow-brown.

Antennal segments III and IV with $0 + 1$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae short and pointed; pronotal antero-marginal and mid-lateral setae vestigial; macropterous, fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX pointed or blunt.

The syntypes of *talpa* were collected at Potgietersrust, South Africa (Faure, 1955) and not Rustenburg (Priesner, 1930). I do not know their whereabouts; they are not in either Priesner's collection (SMF) or Faure's collection (National Insect Collection, Pretoria). The Indian specimens examined agree with Faure's (loc. cit.) excellent redescription.

SPECIMENS STUDIED.

INDIA: Waltair, 3 ♀, 3 ♂, on grass, 27.x.1965 (*TNA*) (USNM).

Haplothrips (Trybomiella) tirumalraoi Ramakrishna & Margabandhu

Haplothrips (*Trybomiella*) *tirumalraoi* Ramakrishna & Margabandhu, 1931 : 1038. Holotype ♂, INDIA: Northern Circars (presumed lost) [not examined].

Ramakrishna & Margabandhu (1931) described *tirumalraoi* from a unique male collected on *Colocasia* (*V. Tirumal Rao*). This specimen is apparently lost. According to the original description antennal segment III bears one sense cone, the fore wings lack duplicated cilia and the post-ocular setae are blunt.

KARNYOTHRIPS Watson

Karynia [sic] Watson, 1922 : 6. Type-species: *Karynia weigeli* Watson [= *Anthothrips flavipes* Jones; synonymized by Hood, 1927 : 175]. [Misspelling for *Karnyia*; preoccupied by *Karnyia* Shelford, 1909.]
Karnyothrips Watson, 1924 : 23. [Replacement name for *Karnyia* Watson.]

The genus *Karynothrips* is used here for a group of *Haplothrips*-like species with forwardly directed fore tarsal claws, $1 + 2^{+1}$ or fewer sense cones on antennal segment IV and two pairs of well developed wing-retaining setae on each of abdominal tergites III–VII. In addition the post-ocular setae are expanded apically and the pronotal antero-marginal setae are vestigial.

Only two species, *flavipes* Jones and *nigriflavus* Ramakrishna, are listed by Ananthakrishnan (1969) as occurring in India. However, the so called colour forms of *nigriflavus* referred to by Ananthakrishnan (1965) are recognized as three distinct species, *nigriflavus*, *melaleucus* Bagnall and *alpha* sp. n. A further species, *mucidus* (Ananthakrishnan & Jagadish) is here transferred to *Karnyothrips* from *Xylaplothrips*. Of the five species recognized here from India at least two are predatory. One of these and two other species are bicoloured and are associated with grasses.

Generic definition. Medium sized brown or bicoloured Haplothripini. Maxillary stylets long and retracted far into the head capsule; maxillary bridge present; post-ocular setae expanded apically. Antennal segment III with 0 + 1 or 1 + 1 sense cones; segment IV with $1 + 2^{+1}$ or fewer sense cones. Fore tarsi with a forwardly directed claw. Pronotal antero-marginal setae vestigial; mid-lateral setae well developed and expanded apically. Abdominal tergites III–VII each with two pairs of well developed wing-retaining setae. Macropterous, fore wings with or without duplicated cilia.

Karnyothrips alpha sp. n.

(Text-figs 26, 31)

Ananthakrishnan (1965*b*) listed five colour forms of *nigriflavus* as follows:

'a) Head alone brown, tube brown, rest yellow
b) Head, prothorax, tube brown
c) Head, prothorax, very little of mesothorax, abdominal segment IX and tube brown
d) Head, prothorax, pterothorax, abdominal segments VIII to X brown
e) Almost uniformly brownish individuals.'

I have examined 24 ♀ and 11 ♂ identified by Professor Ananthakrishnan as *nigriflavus* and of these 6 ♀ and 7 ♂ fall into group a; 10 ♀ and 3 ♂ fall into group b and 8 ♀ fall into group d. The remaining 1 ♂ does not fit into any group but comes closest to group e. The group b specimens are identical to the 13 ♀ paratypes of *nigriflavus* that I have examined and have 0 + 1 and 1 + 2 sense cones on antennal segments III and IV respectively and the median setae (B_1) on abdominal tergite IX are expanded apically. However, the group d specimens examined are identical with the holotype of *melaleucus* Bagnall and have 1 + 1 and $1 + 1^{+1}$ sense cones on antennal segments III and IV respectively and the median setae (B_1) on abdominal tergite IX are pointed. Moreover the group a specimens examined differ from both *nigriflavus* and *melaleucus* and have 0 + 1 and 1 + 2 sense cones on antennal segments III and IV respectively and the median setae (B_1) on abdominal tergite IX are pointed. In addition, none of these group a specimens has duplicated cilia on the distal posterior margin of the fore wing. All specimens of *nigriflavus* and *melaleucus* that I have examined have at least one duplicated cilium on one fore wing or the other. The group a specimens are therefore recognized as a distinct species and described here as *alpha* sp. n.

The single anomalous male near group e has 0 + 1 and 1 + 2^{+1} sense cones on antennal segments III and IV respectively and the median setae (B_1) on abdominal tergite IX are expanded apically, as in *mucidus*. It differs from *mucidus* in colour, i.e. antennal segment III is yellow not brown, and in my opinion probably represents a further new species. Since this specimen is unique I have not described it as a new species.

A total of 6 ♀ and 7 ♂ of *alpha*, 22 ♀ and 2 ♂ of *nigriflavus* and 38 ♀ of *melaleucus* have been examined. Within each species the number of sense cones on antennal segments III and IV, the form of the median setae (B_1) on abdominal tergite IX, the range of the number of duplicated cilia on the fore wing and the colour pattern are consistent.

Bicoloured species of *Karnyothrips*; head, tube, sometimes disal portion of abdominal segment IX, antennal segments I, VII and VIII brown; antennal segment VI usually pale brown in distal half; remainder yellow.

Antennal segments III and IV with 0 + 1 and 1 + 2 sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; macropterous, fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

Measurements of holotype female (smallest–largest holotype female) in μm: total length 2280 (2016–2280); head length 222 (204–222); pronotal length 159 (150–159); tube length 112 (109–117); tube width at base 61 (57–61).

Measurements of smallest–largest paratype males in μm: total length 1296–1680; head length 174–192; pronotal length 111–132; tube length 96–108; tube width at base 43–50.

Holotype ♀, INDIA: Palghat, on bamboo, 28.ix.1965 (*TNA*) (BMNH).

Paratypes. INDIA: 2 ♀, 2 ♂ collected with holotype; Calicut, 1 ♀, 1 ♂ on bamboo, 4.x.1963; Calicut, 1 ♀ on bamboo, 15.x.1964; Chalakudi, 1 ♂ on bamboo, 5.xi.1963: Perintalmanna, 1 ♀ on bamboo, 6.x.1963; Omalur, 1 ♂ on sugar cane, 18.vi.1966; Madras, 1 ♂ on grass, 25.i.1966; Yercaud, 1 ♂ on bamboo, 19.vi.1966; (*TNA*) (BMNH; LCM; USNM).

Karnyothrips flavipes (Jones)

(Text-figs 27, 33)

Anthothrips flavipes Jones, 1912 : 18–19. Holotype ♀, U.S.A.: California, San Jose (USNM) [not examined].

Karnyothrips flavipes (Jones) Hood, 1927 : 175.

Karnyothrips flavipes (Jones); Ananthakrishnan, 1969 : 139.

Brown species; antennal segment III yellow at base, pale brown at apex, segment IV sometimes pale in basal third; femora brown; tibiae yellow-brown to yellow at apex; all tarsi yellow.

Antennal segments III and IV with 1 + 1 and 1 + 2^{+1} sense cones respectively; post ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; macropterous, fore wings with 1–5 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

This species is cosmopolitan (Stannard, 1957; as *jonesianus*) and predates Coccidae, Aleyrodidae and also Acarina on a wide variety of plants (Priesner, 1964*b*). Ananthakrishnan (1969) recorded *flavipes* from India. I have not seen any Indian specimens of this species. The BMNH collection contains material from Egypt, Cyprus and U.S.A. (California and Hawaii).

Karnyothrips melaleucus (Bagnall)

(Text-figs 28, 30)

Hindsiana melaleuca Bagnall, 1911 : 61–62. Holotype ♀, DENMARK: Copenhagen (BMNH) [examined].

Karnyothrips melaleuca (Bagnall) Hood, 1927 : 176.

Bicoloured species; head, thorax, abdominal segments VIII or IX–X brown; pelta and abdominal segments II–VII or VIII yellow, segments III–VII each with a small median transverse pale brown patch near anterior margin; antennal segment I pale brown, segments II–V yellow, VI yellow-brown, VII and VIII brown; fore femora brown in basal half fading to yellow towards apex; mid and hind femora and all tibiae and tarsi yellow.

Antennal segments III and IV with 1 + 1 and 1 + 1^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial; mid-lateral setae expanded apically; wings fully developed, fore wings with 0–4 duplicated cilia (always at least 1 on one fore wing or the other); median setae (B_1) on abdominal tergite IX pointed or blunt.

The Indian specimens examined had been misidentified as *Karnyothrips nigriflavus* by Professor Ananthakrishnan (see discussion under *alpha*). This species is a pantropical thrips living amongst grasses, sometimes in association with scale insects. The BMNH contains material from Denmark (in a palm house), Madeira, Kenya, U.S.A. (Hawaii), Trinidad, Brazil, Australia, West Malaysia, Java, Vietnam, China and India. Unlike *alpha* and *nigriflavus* the males of *melaleucus* are unknown.

SPECIMENS STUDIED.

Holotype ♀, DENMARK: Copenhagen, on cruciferous flowers in palm house, 30.vi.1909 (*R. S. Bagnall*) (BMNH).

INDIA: Palghat, 2 ♀, 28.ix.1965 (BMNH); Kulatupuzha, 2 ♀ on wild grass, 2.ix.1966 (BMNH); Thimbam, 2 ♀ on bamboo, 4.ix.1967 (1 ♀ BMNH; 1 ♀ USNM); Mundumalai, 1 ♀ on bamboo, 24.xii.1966 (USNM); Chalakudi, 1 ♀ on bamboo, 5.xi.1963 (USNM); Calicut, 1 ♀ on bamboo, 4.x.1963 (USNM); all collected by *TNA*. CHINA: Canton, 1 ♀ on *Bambusa*, iii.1938 (BMNH). VIETNAM: 1 ♀ on *Vanda*, 29.xii.1962 (*H. A. Woolford*) (USNM).

Karnyothrips mucidus (Ananthakrishnan & Jagadish) **comb. n.**

Xylaplothrips mucidus Ananthakrishnan & Jagadish, 1971 : 260–261. Holotype ♀, INDIA: Vyithri (Wynad) (LCM) [examined].

Bicoloured species; head, thorax, posterior half of abdominal segment IX, and tube brown, rest of body yellow; fore femora brown with yellow apex; fore tibiae yellow-brown; fore tarsi yellow; mid and hind legs yellow; antennal segments I brown, segment II mainly yellow, segment III yellow, segments IV–VIII brown.

Antennal segments III and IV with 0 + 1 and 1 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial; mid-lateral setae well developed and expanded apically; macropterous, fore wings with about 4 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

This species was originally described from two females and one male collected from dry twigs at Vyithri (Wynad).

SPECIMENS STUDIED.

Holotype ♀, allotype ♂, paratype ♀, INDIA: Vyithri (Wynad), on dry twigs, 15.viii.1969 (*TNA*) (LCM).

Karnyothrips nigriflavus Ramakrishna

(Text-figs 29, 32)

Karnyothrips nigriflavus Ramakrishna, 1934 : 496. Holotype ♀, INDIA: Coimbatore (LCM) [not examined].

Bicoloured species; head, prothorax and tube brown; base and apex of antennae pale brown; remainder yellow.

Antennal segments III and IV with 0 + 1 and 1 + 2 sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed; macropterous, fore wings with 1–5 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Ramakrishna (1934) described *nigriflavus* from 'numerous specimens (T.V.R. No. 269a)' collected on bamboo in Coimbatore. He referred to a 'type female' but made no mention of any males. Professor Ananthakrishnan kindly loaned a slide of *nigriflavus* from Ramakrishna's collection (T.V.R. 269). This unfortunately was broken in transit, although none of the specimens were damaged. The slide originally held 13 females of *nigriflavus* and a single specimen of an unidentified *Xylaplothrips* sp. I have remounted all of these singly on slides.

I regard the colour forms of *nigriflavus* referred to by Ananthakrishnan (1965*a*) as at least three distinct species (see discussion under *alpha*).

SPECIMENS STUDIED.

Paratypes 13 ♀, INDIA: Coimbatore, on bamboo (*T. V. Ramakrishna* 269) (LCM; BMNH).

INDIA: Palghat, 3 ♀, 1 ♂ on bamboo, 4.ix.1967 (BMNH); Perintalmanna, 1 ♀ on grass, 5.xi.1963 (BMNH); Aryankavu, 1 ♀, 21.ii.1966 (USNM); Yercaud, 1 ♀ on bamboo, 19.vi.1966 (USNM); Tumkur, 1 ♀ on bamboo, 5.ix.1967 (USNM); Dindigul, 1 ♀ on bamboo, 28.vii.1967 (USNM); Calicut, 1 ♀, 1 ♂ on bamboo, 4.x.1963 (USNM); Chalakudi, 1 ♀ on bamboo, 5.xi.1963 (USNM); all collected by *TNA*.

PRAEPODOTHRIPS Priesner & Seshadri

Praepodothrips Priesner & Seshadri, 1952 : 407–410. Type-species: *Praepodothrips indicus* Priesner & Seshadri, 1952 : 408–410, by original designation.

Praepodothrips is used here for a group of four large grass-inhabiting haplothripines. Three of these have relatively large heads and small pronota and 1 + 1 sense cones on antennal segment IV. The fourth species has the head only about as long as the pronotum and $2 + 2^{+1}$ sense cones on antennal segment IV. This last-mentioned species possibly warrants a genus of its own but is retained for the present in *Praepodothrips*.

Generic definition. Large brown or bicoloured species of Haplothripini. Head usually relatively large; maxillary stylets retracted far into the head capsule; maxillary bridge present. Antennal segment III with 0 + 1 to 1 + 2 sense cones; segments IV with 1 + 1 or $2 + 2^{+1}$ sense cones; post ocular setae pointed to expanded. Pronotal antero-marginal and mid lateral setae vestigial. Macropterous, forewings with or without duplicated cilia. Abdominal tergites III–VII each with two pairs of well developed wing-retaining setae.

Praepodothrips cymbapogoni Ananthakrishnan

(Text-figs 46, 50)

Praepodothrips cymbapogoni Ananthakrishnan, 1956 : 136–138. Holotype ♀, India: Simuralai Hills (LCM) [not examined].
Praepodothrips cymbapogoni Ananthakrishnan; Ananthakrishnan, 1960 : 574.

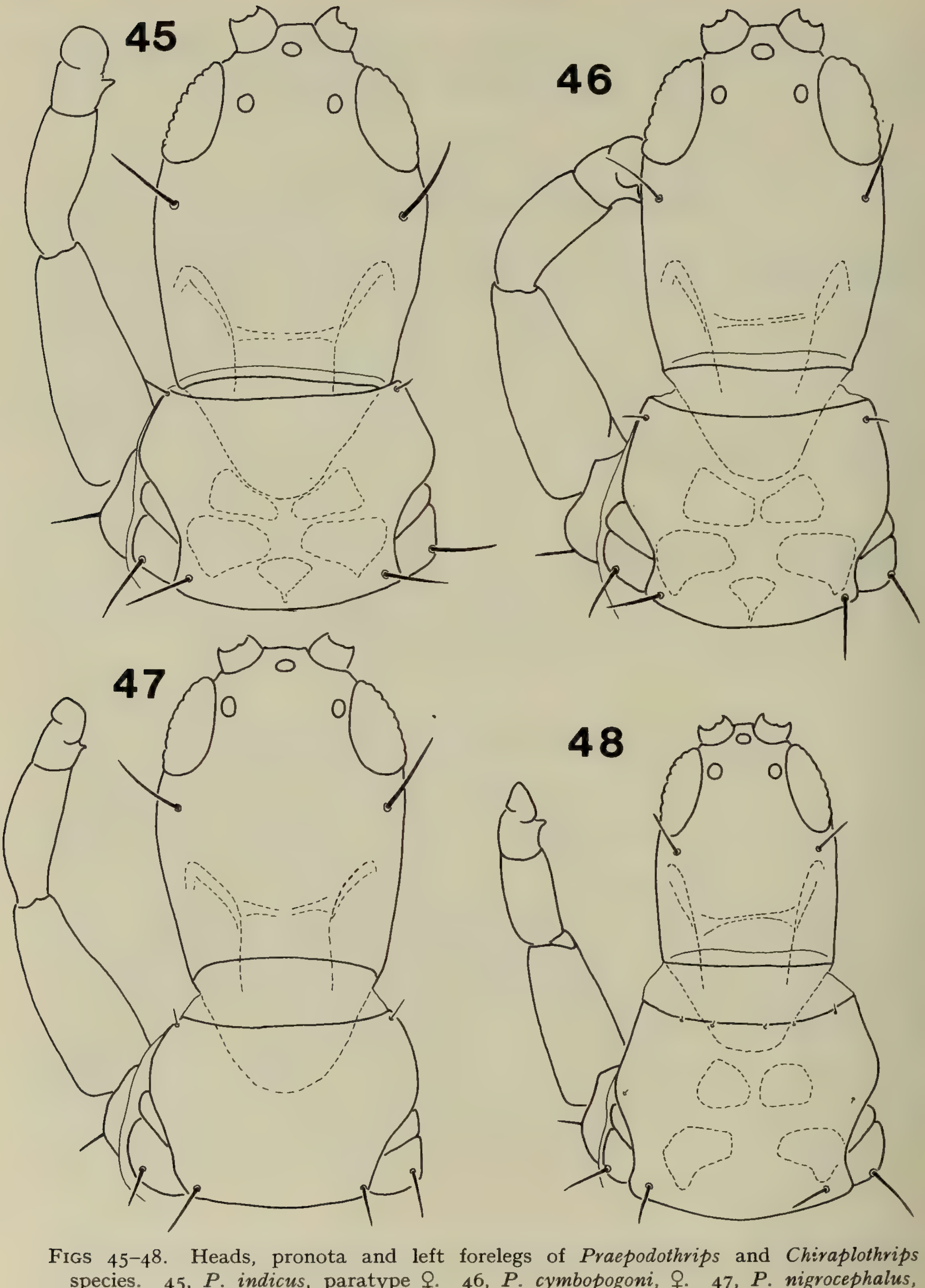
Brown species; apical half to third of antennal segment II, segments III–VI yellow, remainder of antennae pale brown; apex of fore femora, all tibiae and tarsi yellow.

Antennal segments III and IV each with 1 + 1 sense cones; post-ocular setae pointed; pronotal antero-marginal setae apparently vestigial; macropterous, fore wings with 5–7 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from two females collected on *Cymbapogon citratus* (Candolle) Stapf from Sirumalai Hills, Madras Province (*TNA*) (Ananthakrishnan, 1956). The only specimen examined for the present study, which was identified by Professor Ananthakrishnan, is unfortunately mounted ventral side up and the pronotal setae are not readily discernible.

Specimen studied.

India: Coonoor, 1 ♀ on *Cymbapogon citratus* (Condolle) Stapf, iv.1958 (*TNA*) (BMNH).



FIGS 45–48. Heads, pronota and left forelegs of *Praepodothrips* and *Chiraplothrips* species. 45, *P. indicus*, paratype ♀. 46, *P. cymbopogoni*, ♀. 47, *P. nigrocephalus*, holotype ♀. 48, *C. graminellus*, paratype ♀.

Praepodothrips indicus Priesner & Seshadri

(Text-figs 45, 49)

Praepodothrips indicus Priesner & Seshadri, 1952 : 408–410. Syntypes ♀, ♂, INDIA: Valparai (Tamil Nadu University, Coimbatore; Zoological Survey, Calcutta; SMF) [2 ♀ examined].

Bicoloured species; head, thorax, abdominal segments IX–X brown; abdominal segment VIII yellow in anterior third, brown in posterior two-thirds, segments II–VII yellow, segments III–VI tinged brown medially, segment VII also tinged brown in posterior fourth; antennal segments I, basal half and interior distal portion of segment II, segment VIII brown; all legs yellow, margins of fore femora slightly tinged with brown.

Antennal segments III and IV each with 1 + 1 sense cones; post-ocular setae pointed, rarely blunt; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and pointed; macropterous, fore wings with 4–8 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from 'several individuals of both sexes' from Valparai, south India, collected on an unknown host plant 'but most likely Gramineae sp'. The two syntypes examined are both labelled 'Paratype'.

SPECIMENS STUDIED.

Syntypes 2 ♀, INDIA: Valparai, ix.1945 (*E. R. G. Menon*) (SMF).

INDIA: Pachmarhi, 5 ♀ on grass, 21.xi.1966; Valparai, 1 ♀, 2 ♂ on lemon grass, 26.ix.1965; Ooty, 1 ♀ on *Imperata* grass, 25.ii.1966; Yercaud, 1 ♂, on *Imperata* grass, 17.vi.1966; Salem, 1 ♀, 1 ♂ on grass, 19.vii.1963; (*TNA*) (BMNH).

Praepodothrips nigrocephalus Ananthakrishnan

(Text-figs 47, 51)

Praepodothrips nigrocephalus Ananthakrishnan, 1964*b* : 228. LECTOTYPE ♀, INDIA: Kodaikanal Hills (LCM), here designated [examined].

Bicoloured species; mainly yellow; head, posterior third of abdominal segment IX, tube antennal segment I and most of segment II and segment VIII brown; remainder yellow.

Antennal segments III and IV with 0 + 1 and 1 + 1 sense cones respectively; post-ocular setae pointed; pronotal antero-marginal setae vestigial, mid-lateral setae vestigial; macropterous fore wings without duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from '18 females and 3 males' from grasses, Kodaikanal Hills, India (Ananthakrishnan, 1964*b*). The female and male syntype examined are labelled 'Holotype' and 'Allotype' respectively. The female is here designated as the lectotype, the remaining 17 females and 3 males being regarded as paralectotypes.

SPECIMENS STUDIED.

Lectotype ♀, paralectotype ♂, INDIA: Kodaikanal Hills, 9.xii.1963 (*TNA*) (LCM).

Praepodothrips priesneri Ananthakrishnan

(Text-fig 52)

Praepodothrips priesneri Ananthakrishnan, 1955 : 608–612. Holotype ♀, INDIA: S., Madras (LCM) [examined].

Dark brown species; antennal segment III–VII almost entirely yellow; apex of fore femora yellow; fore tibiae yellow at base and apex, tinged brown medially on margins; mid and hind tibiae yellow at base; all tarsi yellow.

Antennal segments III and IV with $1 + 2$ and $2 + 2^{+1}$ sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae vestigial; macropterous, fore wings with 6–9 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed or blunt.

Although *priesneri* is a fairly large grass-inhabiting haplothripine, as are the other species treated here under *Praepodothrips*, its head is only about as long as the pronotum and there are $2 + 2^{+1}$ sense cones on antennal segment IV.

SPECIMENS STUDIED.

Holotype ♀, allotype ♂, INDIA: S., Madras, bamboo sheaths, 12.vi.1954 (*TNA*) (LCM).

XYLAPLOTHRIPS Priesner

Haplothrips (*Xylaplothrips*) Priesner, 1928 : 572. Type-species: *Haplothrips fuliginosus* (Schille), by monotypy.
Xylaplothrips Priesner; Priesner, 1964*a* : 171.

The genus *Xylaplothrips* was erected as a subgenus of *Haplothrips* by Priesner (1928). He distinguished *Xylaplothrips* from *Haplothrips* sensu stricto by the symmetrical antennal segment III bearing two sense cones and also by the fungus-feeding habit. Priesner (1964*a*) elevated *Xylaplothrips* to generic rank. Subsequently *Xylaplothrips* has been used by authors for fungus-feeding *Haplothrips*-like species regardless of the number of sense cones on antennal segment III.

The 10 species recorded from India and discussed here under *Xylaplothrips* are probably polyphyletic and moreover none of them are strictly congeneric with *fuliginosus*, which is European.

GENERIC DEFINITION. Small to large species of Haplothripini. Maxillary stylets long, retracted far into the head capsule, maxillary bridge present; post-ocular setae expanded apically. Antennal segment III usually with $1 + 2$ sense cones, sometimes fewer; segment IV usually with $2 + 2^{+1}$ sense cones, sometimes fewer. Pronotal antero-marginal setae usually well developed, sometimes vestigial; mid-lateral setae well developed and usually expanded apically. Usually macropterous, rarely apterous; fore wings, when present and fully developed, with duplicated cilia. Abdominal tergites III–VII each with two pairs of well developed wing-retaining setae.

Xylaplothrips debilis Ananthakrishnan & Jagadish

(Text-fig 56)

Xylaplothrips debilis Ananthakrishnan & Jagadish, 1971 : 266–267. Holotype ♀, INDIA: Kulatupuzha (Kerala) (LCM) [examined].

Brownish species; head, thorax and tube brown, rest of body brownish yellow; antero-median regions of abdominal segments II–VIII with brownish patches; legs yellow except median portions of femora which are shaded with brown; antennal segments I and V–VIII brown, segment II brown in basal half, yellowish apically, segment III yellow in basal half, brown apically.

Antennal segments III and IV each with 1 + 1 sense cones; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 4–6 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was described from two females collected at Kulatupuzha and two females collected at Aryankavu. One of the female paratypes from Aryankavu has been examined for the present study but this differs from the holotype female from Kulatupuzha in having 1 + 2 and 2 + 2 sense cones on antennal segments III and IV respectively and cannot be distinguished from *pusillus*. The holotype female of *debilis* is very similar to *pusillus* and it is possible that this female is merely an aberrant specimen of *pusillus*. The female of *debilis* in the USNM that I have examined had been misidentified by Professor Ananthakrishnan as *tener*. This specimen has identical data to a female of *ligs* in the USNM and it may be that the two were collected together.

SPECIMENS STUDIED.

Holotype ♀, INDIA: Kulatupuzha (Kerala) dry twigs, 7.x.1969 (*TNA*); paratype ♀, INDIA: Aryankavu (Kerala) dry twigs, 12.xi.1969 (*TNA*) (USNM).

INDIA: Tirupathi, 1 ♀ on dry twig, 31.vii.1969 (*TNA*) (USNM).

Xylaplothrips emineus Ananthakrishnan & Jagadish

(Text-fig. 55)

Xylaplothrips emineus Ananthakrishnan & Jagadish, 1971 : 264. Holotype ♀, INDIA: Tirupathi, dry twigs, 16.vii.1969 (*TNA*) (LCM). [1 ♀, 1 ♂ ?paratypes examined].

Bicoloured species; head, lateral margins of pterothorax, anterior margin of abdominal segment II and tube brown; abdominal tergites III–VIII yellow with median transverse patches near anterior margins; abdominal tergite IX yellow-brown; antennae except segment III brown; segment III yellow.

Antennal segments III and IV with 1 + 2 and 2 + 2 sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 4–6 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Neither of the specimens examined for the present study are labelled as type-material although they bear identical data to some of the paratypes. This species was originally described from five females and three males collected at Tirupathi, Courtallam, and Aryankavu on dry twigs. I have examined a specimen in the USNM from Tirupathi identified as *tener* which I cannot distinguish from *debilis*.

SPECIMENS STUDIED.

?Paratypes 1 ♀, 1 ♂, INDIA: Aryankavu, Tenmalai (Kerala), dry twigs, 12. xi.1969 (*TNA*) (LCM).

Xylaplothrips flavitibia Ananthakrishnan & Jagadish

(Text-fig. 62)

Xylaplothrips flavitibia Ananthakrishnan & Jagadish, 1969 : 128–129. LECTOTYPE ♀, INDIA: Courtallam (*TNA*) (LCM), here designated [examined].

Brown species; antennal segment III yellow, segments IV–VI yellow in basal two-thirds, tinged with brown in apical third, remaining segments brown; fore femora brown with yellow apex; mid and hind femora brown; all tibiae and tarsi yellow.

Antennal segments III and IV with 1 + 2 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; macropterous, fore wings with 4–8 duplicated cilia; median setae (B_1) on abdominal tergite IX very slightly expanded.

Ananthakrishnan & Jagadish (1969) described *flavitibia* from three females and four males from Courtallam and Pachmarhi but did not designate any of these specimens as the holotype. The female and male syntypes from Courtallam I have examined are labelled 'HOLOTYPE' and 'ALLOTYPE' respectively. The female labelled 'HOLOTYPE' is here designated as the lectotype. The two specimens I have examined from Pachmarhi have identical data to some of the syntypes but are not labelled as type-material.

SPECIMENS STUDIED.

Lectotype ♀, INDIA: Courtallam, wild galls, 20.vii.1963 (*TNA*) (LCM). ?Paralectotypes 1 ♀, 1 ♂, INDIA: Pachmarhi, wild galls, 21.xi.1966 (*TNA*) (USNM).

INDIA: Allahabad, 2 ♀ galling *Acacia leucophloeae* Wildenow, reared 1.xii.1966 (*B. D. Agarwal*) (USNM).

Xylaplothrips flavus Ananthakrishnan

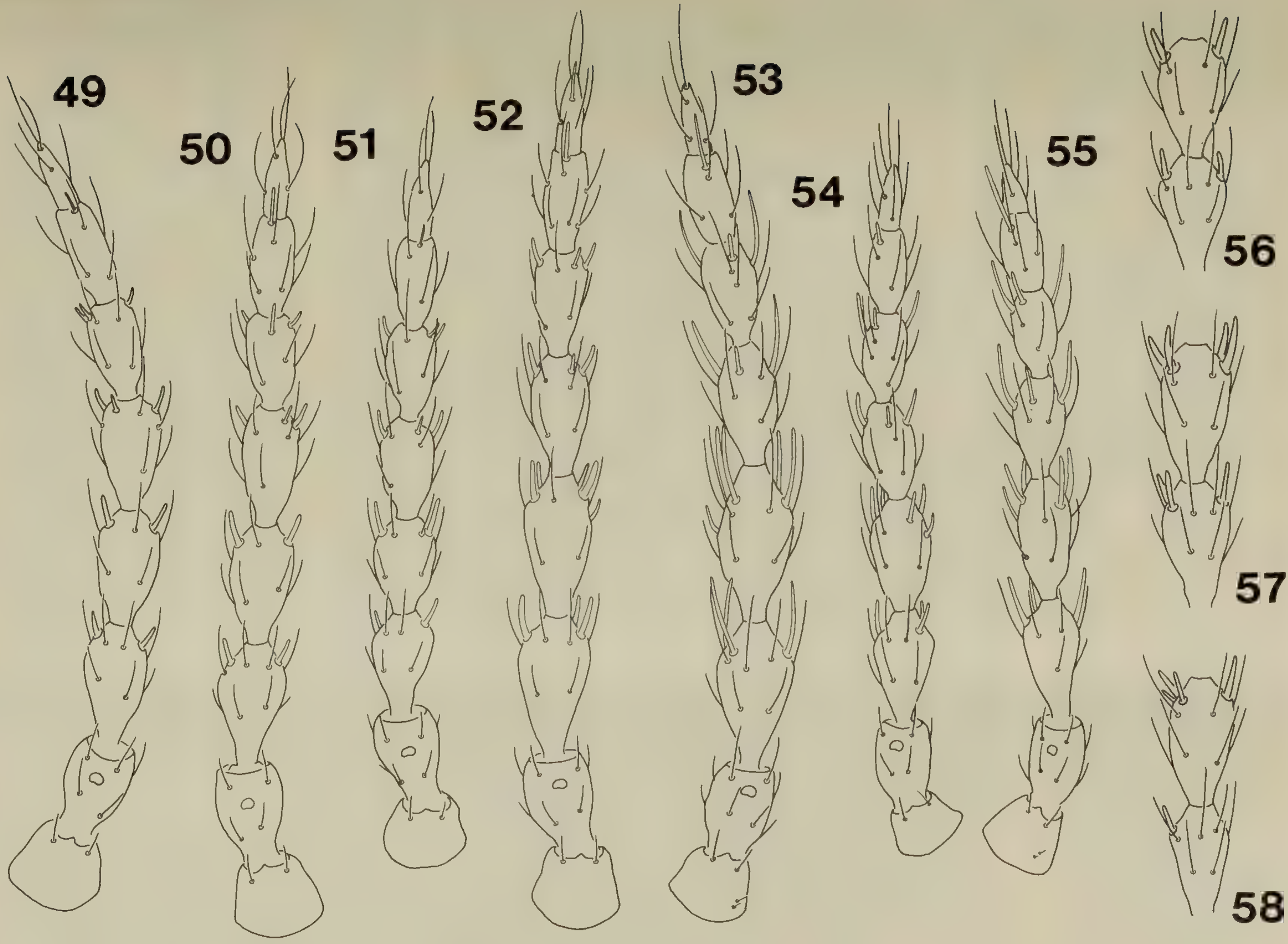
(Text-fig. 54)

Xylaplothrips flavus Ananthakrishnan, 1964*a* : 51–52. Syntypes 2 ♀, 4 ♀, INDIA: Sirumalai Hills (LCM) [1 ♀ examined].

Brown species; antennal segment III yellow, segments IV and V yellow at base, pale brown at apex, segment VI pale brown, yellow at extreme base; all femora brown, yellow brown at apex; all tibiae yellow tinged with brown medially; all tarsi yellow.

Antennal segments III and IV with 1 + 2 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 4–5 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

This species was originally described from two females and four males collected at Sirumalai Hills in palm inflorescences. None of these specimens was designated as the holotype although the single female syntype examined is labelled 'Paratype'.



FIGS 49–58. Antennae of *Praepodothrips* and *Xylaplothrips* species. 49, *P. indicus*, paratype ♀. 50, *P. cymbapogoni*, ♀. 51, *P. nigrocephalus*, holotype ♀. 52, *P. priesneri*, holotype ♀. 53, *X. inquilinus*, lectotype ♀. 54, *X. flavus*, syntype ♀. 55, *X. emineus*, ♀. 56, *X. debilis*, holotype ♀, segments III and IV. 57, *X. pusillus* (paratype ♀ of *debilis*), segments III and IV. 58, *X. ligs*, holotype ♀, segments III and IV.

The only other specimen I have examined has identical data but is not labelled as a type.

SPECIMENS STUDIED.

Syntype ♀, ?syntype ♂, INDIA: S. Sirumalai Hills, inflorescence of wild palm, 1959 (*TNA*) (LCM).

Xylaplothrips inquilinus (Priesner) **comb. n.**

(Text-fig. 59)

Haplothrips inquilinus Priesner, 1921 : 4. LECTOTYPE ♀, JAVA: Semarang (SMF), here designated [examined].

Xylaplothrips inquilinus Ananthakrishnan, 1966 : 13. Syntypes 9 ♀, 3 ♂, INDIA: Perintalmanna (Kerala); Alargarkoil (Madura); and Araku Valley (Andrha) (LCM) [2 ♀ ?syntypes examined]. **Syn. n.**

Xylaplothrips longus Ananthakrishnan & Jagadish), 1969 : 129. LECTOTYPE ♀, INDIA: Tirupathi, here designated (LCM) [examined]. **Syn. n.**

Xylaplothrips orientalis Ananthakrishnan & Jagadish, 1969 : 129. Syntypes 4 ♀, 3 ♂, INDIA: Tirupathi; Tambaram (LCM) [not examined]. **Syn. n.**

Brown species; antennal segments III–VI usually yellow in basal half, pale brown in distal half, rarely almost completely yellow; segments I–II, VII–VIII brown; mid and hind femora brown; mid tibiae yellow at base and in apical half; hind tibiae yellow at base and apex.

Antennal segments III and IV with 1 + 2 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed; macropterous, fore wings with 5–8 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed or blunt.

Priesner (1921) described *inquilinus* from two females and four males collected at Semarang, Java in galls on *Ficus benjamina* L., 9.iii.1912 and *Smilax* sp., 5.i.1912 (*Docters v. Leeuwen*). I have examined all of these specimens which are mounted on two slides. One male and one female are mounted on a single slide with a specimen of '*Andothrips melastomae*'. This female is here designated as the lectotype.

I have examined females of '*inquilinus* Anan. sp. n./T. N. ANANTHAKRISHNAN' from Alargarkoil and Perintalmanna which bear identical data to some of the syntypes of *inquilinus* Ananthakrishnan. Although these are not labelled as such, I suspect they are syntypes.

Xylaplothrips longus was described from two females collected at Tirupathi. Neither of these specimens was designated as the holotype although the female syntype examined is labelled 'HOLOTYPE'. This female is here designated as the lectotype.

The above synonymies are based on examination of the lectotype and paralectotypes of *inquilinus* Priesner, two ? syntypes of *inquilinus* Ananthakrishnan, the lectotype of *longus* and a specimen of *orientalis* identified by Professor Ananthakrishnan. In addition to this material I have seen a female of *inquilinus* Ananthakrishnan identified by Professor Ananthakrishnan. This specimen has identical data to the lectotype and paralectotype of *longus* and the female and male syntypes of *orientalis* from Tirupathi.

SPECIMENS STUDIED.

Lectotype ♀, paralectotype ♂ of *inquilinus* Priesner, JAVA: Semarang, 'in Gallen auf *Ficus benjamina* L.', 9.iii.1912 (*Docters v. Leeuwen*) (SMF); paralectotypes 3 ♀, 1 ♂ of *inquilinus* Priesner, JAVA: Semarang, 'in Ballgallen auf *Smilax* spec.' 5.i.1912 (*Docters v. Leeuwen*) (SMF). Lectotype ♀ of *longus*, INDIA: Tirupathi, *Pavetta* sp. 10.viii.1965 (*TNA*) (LCM).

?Syntypes 2 ♀ of *inquilinus* Ananthakrishnan, INDIA: 1 ♀ Perintalmanna, *Pavetta* galls with *Teucho. longus*, 5.xi.1963 (*TNA*) (LCM); 1 ♀ Alagarkoil, *Pavetta* galls with *Teucho*, 10.ix.1964 (*TNA*) (USNM).

INDIA: Tirupathi, 1 ♀ on *Pavetta* sp. galls, 10.viii.1965 (*TNA*) (LCM).

Xylaplothrips ligs Ananthakrishnan & Jagadish

(Text-fig. 58)

Xylaplothrips ligs Ananthakrishnan & Jagadish, 1971 : 261–263. Holotype ♀, INDIA: Tirumalai, Tirupathi (LCM) [examined].

Brown species; tarsi paler; antennal segment III yellow with yellowish brown apex.

Antennal segments III and IV with 0 + 1 and 1 + 2 sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 5–6 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.

I have examined the holotype female and allotype male of *ligs* and a second female with identical data to the paratype female. The male differs from both the females in having 1 + 1 sense cones on each of antennal segments III and IV as in *debilis*. I have suggested above that *debilis* may be an aberrant form of *pusillus* and it is possible that *ligs* is likewise an aberrant form. I have examined material of *pusillus* and *debilis* with identical data and material of *pusillus* and *ligs* with identical data.

SPECIMENS STUDIED.

Holotype ♀, INDIA: Tirumalai, Tirupathi, on dry twigs, 19.vii.1969 (*TNA*) (LCM).
INDIA: Tirumalai, Tirupathi, 1 ♀ on dry twigs, 31.vii.1969 (*TNA*) (USNM).

Xylaplothrips micans Ananthakrishnan & Jagadish

Xylaplothrips micans Ananthakrishnan & Jagadish, 1971 : 265–266. Holotype ♀, INDIA: Aryankavu (LCM) [examined].

Mainly yellow species; apex of head, mesothorax, posterior portion of pelta and anterior half of abdominal segment II and tube brown; antennal segments I–III yellow, remaining segments yellow; all legs yellow.

Antennal segments III and IV with 1 + 1 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal setae vestigial, mid-lateral setae well developed and expanded apically; macropterous or apterous; fore wings when fully developed with 6–7 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Ananthakrishnan & Jagadish (1971) described *micans* from a total of three females and three males collected on dry and decaying twigs and bark at Aryankavu, Kodaikanal and Madras. The original description refers only to macropterous females and males. Although the holotype female is macropterous, the female paratype that I have examined is apparently apterous.

SPECIMENS STUDIED.

Holotype ♀ macroptera, INDIA: Aryankavu, dry twigs, 12.xi.1969 (*TNA*) (LCM); paratype ♀ aptera, Kodaikanal, *Lantana* twigs, 31.xii.1968 (*TNA*) (LCM).

Xylaplothrips pictipes (Bagnall)

(Text-fig. 61)

Haplothrips pictipes Bagnall, 1919 : 273–274. Lectotype ♀, INDIA: Talimparamta Malabar (BMNH), designated by Mound (1968 : 139) [examined].
Neoheegeria pictipes (Bagnall) Mound, 1968 : 139.
Xylaplothrips pictipes (Bagnall) Ananthakrishnan, 1969 : 122.

Brown species; intermediate antennal segments paler; apex of fore femora yellow, tinged with brown medially, yellow at base; tarsi yellow.

Antennal segments III and IV with 1 + 2 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 5–7 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed or blunt.

The two female specimens in the USNM that I have examined had been misidentified as '*Xylaplothrips mimus* Pr.' This species differs from *pictipes* in having 1 + 1 and 1 + 2 sense cones on antennal segments III and IV respectively.

SPECIMENS STUDIED.

Lectotype ♀, paralectotypes 2 ♀, INDIA: Malabar, on diseased pepper berries, ix.1918 (*Ramakrishna*) (BMNH).

INDIA: Hubli, 2 ♀ on grass, 17.xi.1964 (*TNA*) (USNM).

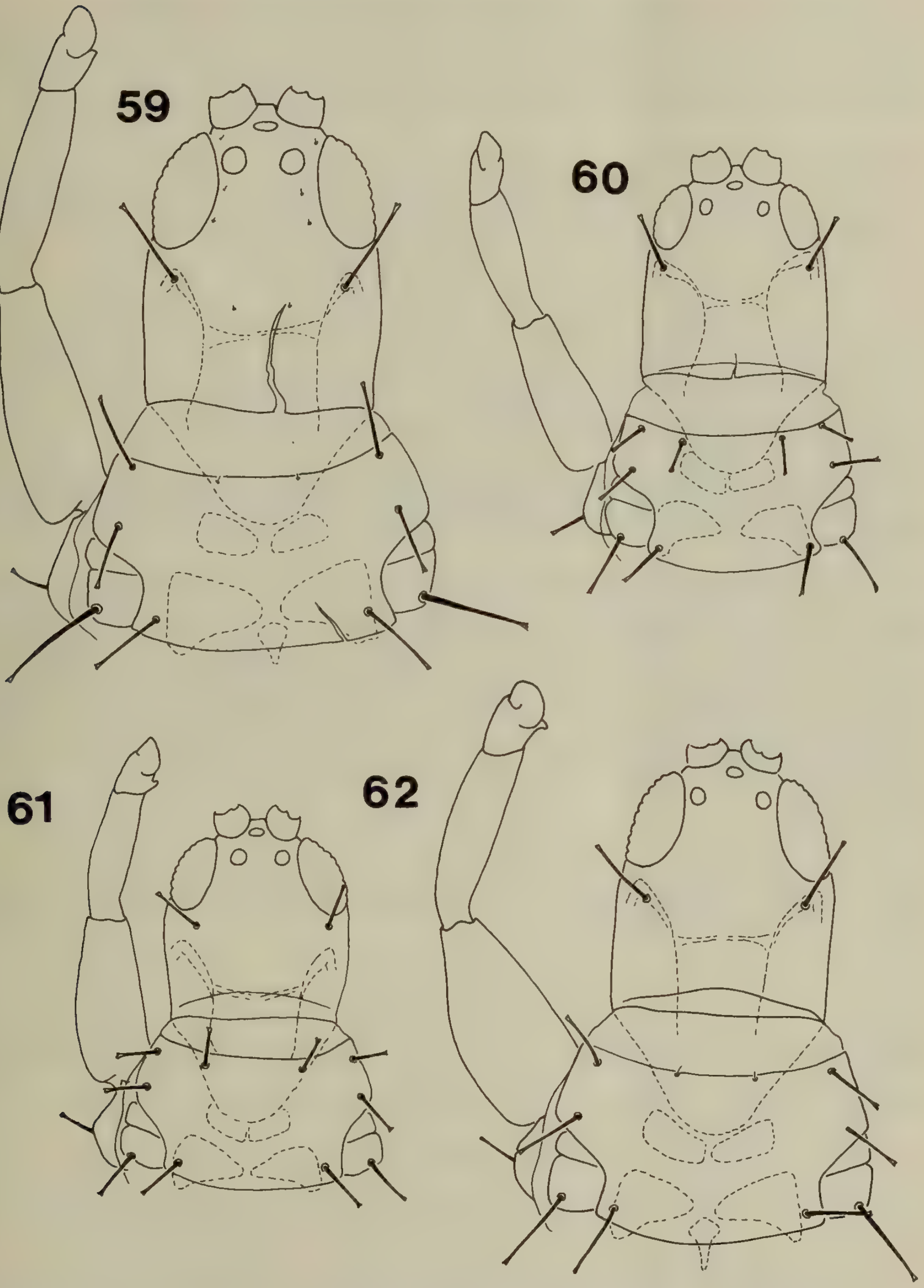
Xylaplothrips pusillus Ananthakrishnan & Jagadish

(Text-fig. 57)

Xylaplothrips pusillus Ananthakrishnan & Jagadish, 1969 : 125–126. Syntypes 1 ♀, 1 ♂, INDIA: Kulatupuzha (LCM) [not examined].

Yellow-brown species; head, thorax and tube brown; abdominal segments II–IX yellow-brown, segments II–VIII with a brown median transverse patch, segment IX darker posteriorly; antennal segment I brown, segments II and III yellow brown, segment III with extreme apex brown, segments IV–VIII brown, darker than head; femora brownish yellow; all tibiae and tarsi yellow.

Antennal segments III and IV with 1 + 2 and 2 + 2 sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae well developed and expanded apically; macropterous, fore wings with 4–5 duplicated cilia; median setae (B_1) on abdominal tergite IX pointed.



FIGS 59–62. *Xylaplothrips* species: heads, pronota and left forelegs. 59, *inquilinus*, ♀. 60, *pusillus*, ♀. 61, *pictipes*, ♀. 62, *flavitibia*, ♀.

The above morphological diagnosis is based on a single female from Tirupathi identified by Professor Ananthakrishnan as *pusillus*. I am unable to distinguish this from the paratype females of *debilis* from Aryankavu that I have examined. As stated above I suspect that both *debilis* and *ligs* are forms of *pusillus*.

SPECIMENS STUDIED.

INDIA: Tirupathi, 1 ♀ on dry *Smilax* twigs, 21.vi.1970 (*TNA*) (LCM); paratype ♀ of *debilis*, Aryankavu, on dry twigs, 12.vi.1968 (*TNA*) (LCM).

Xylaplothrips tener Ananthakrishnan & Jagadish

Xylaplothrips tener Ananthakrishnan, 1969 : 126–128. LECTOTYPE ♀, INDIA: Goa-Londa Border (LCM), here designated [examined].

Brown species; antennal segment III yellow in basal half, brownish yellow in apical half; tibiae yellow sometimes tinged with brown medially; all tarsi yellow.

Antennal segments III and IV with 1 + 2 and 2 + 2^{+1} sense cones respectively; post-ocular setae expanded apically; pronotal antero-marginal and mid-lateral setae expanded apically; macropterous, fore wings with 4–6 duplicated cilia; median setae (B_1) on abdominal tergite IX expanded apically.

Ananthakrishnan & Jagadish (1969) described *tener* from two females and two males collected at Goa-Londa Border but did not designate any of these specimens as the holotype. I have examined a syntype female labelled 'HOLOTYPE' which is here designated as the lectotype. I have also examined a male specimen labelled 'ALLOTYPE' but this is apparently from 'Kulatupuzha, on *Areca* sheath, 25.i.1967 (TNA)'. These data, however, have been crossed out. The only other specimen identified by Professor Ananthakrishnan as *tener* that I have seen is in fact *debilis*.

SPECIMENS STUDIED.

Lectotype ♀, INDIA: Goa-Londa Border, 12.x.1965 (*TNA*) (LCM); paralectotype ♂, ? collected with lectotype.

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CONSTITUENT GENERA, REVIEW OF SMALLER GENERA AND REVISION OF *TRIGLYPHOTHRIX* FOREL

B. BOLTON

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BY

BARRY BOLTON

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TETRAMORIINI (HYMENOPTERA : FORMICIDAE)

CONSTITUENT GENERA, REVIEW OF SMALLER GENERA AND REVISION OF *TRIGLYPHOTHRIX* FOREL

By B. BOLTON

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SYNOPSIS

The generic composition of the myrmicine ant tribe Tetramoriini is revised and the tribe re-defined. Seven genera are recognized as valid, namely *Anergates* Forel, *Decamorium* Forel, *Rhoptromyrmex* Mayr, *Strongylognathus* Mayr, *Teleutomyrmex* Kutter, *Tetramorium* Mayr and *Triglyphothrix* Forel. The genus *Ireneella* Donisthorpe is synonymized with *Rhoptromyrmex*. The genera *Macromischoides* Wheeler and *Xiphomyrmex* Forel, and the subgenera *Lobomyrmex* Kratochvil and *Sulcomyrmex* Kratochvil are synonymized with *Tetramorium*. The genera *Eutetramorium* Emery, *Ireneopone* Donisthorpe and *Tetramyrma* Forel are excluded from the tribe. Keys to genera are given.

Tetramorium is defined and discussed as a preliminary to a world revision. The smaller genera are reviewed and a new species of *Rhoptromyrmex* described. *Triglyphothrix* is formally revised, 55 species being recognized as valid, of which 21 are new. Keys to species are provided for *Decamorium*, *Rhoptromyrmex* and *Triglyphothrix*. The species *Tetramorium opacum* (F. Smith) is transferred to genus *Romblonella* Wheeler (tribe Meranoplini), and *Xiphomyrmex flavigaster* Clark is transferred to genus *Chelaner* Emery (tribe Solenopsidini).

Genus *Atopula* is transferred from tribe Myrmecinini and synonymized with *Tetramorium*. Of the former species of *Atopula*, *belti* (Forel) is transferred to *Brunella* Forel, *longispina* Stitz is transferred to *Paratopula* Wheeler, and *hortensis* Bernard is synonymized with *Tetramorium sericeiventre* Emery.

INTRODUCTION

THIS paper is the first part of a projected revision of the ant tribe Tetramoriin and presents a review, with keys where possible, of all the smaller genera of the tribe and also gives a formal revision of the moderately sized genus *Triglyphothrix*. The genus *Tetramorium* is very large, larger than the rest of the tribe together, and will be dealt with separately in one or more papers which are now in preparation. The present paper only gives a definition and discussion of the genus and its synonyms.

The course of the study at the generic level has led to a number of interesting discoveries which make it possible to define the tribe accurately, but unfortunately it has also led to the conclusion that a number of quite well-known and old generic names have no validity. In this category come *Xiphomyrmex* and *Macromischoides*, both now relegated to the synonymy of *Tetramorium*. Other casualties include the spurious subgenera *Lobomyrmex* and *Sulcomyrmex* of *Tetramorium*, which are synonymized, and the monotypic *Ireneella*, based on a male, is sunk under *Rhoptromyrmex*. Three small and very poorly known genera which were formerly placed in the tribe, namely *Eutetramorium*, *Ireneopone* and *Tetramyrma*, are excluded from further consideration of the Tetramoriini and are assigned to different tribes elsewhere in the subfamily Myrmicinae.

In distribution most of the genera of the tribe Tetramoriini are primarily of the Old World tropics and subtropics, particularly the Ethiopian, Malagasy and Indo-Australian regions. A few Holarctic species of *Tetramorium* are known but only a single species is unquestionably endemic in the New World, *Tetramorium spinosum* (Pergande), which is found in the more arid regions of the southern U.S.A. and Mexico. The Palaearctic region has three endemic genera, *Anergates*, *Teleutomyrmex* and *Strongylognathus*. The first two of these are monotypic genera and are permanent social parasites without a worker caste. The last named is a dulotic genus with falcate mandibles. All the species of these genera utilize species of the

Tetramorium caespitum-group as hosts. The small genus *Decamorium* is restricted to the Ethiopian region but the larger genera *Rhoptromyrmex* and *Triglyphothrix* are found throughout the Old World tropics although no endemic species of these are known from either Madagascar or Australia. Finally, the huge genus *Tetramorium* is based upon the Ethiopian region but is also very strongly represented throughout the Old World tropics and subtropics. One group of this genus, the *T. caespitum*-group, has colonized the more temperate and Mediterranean zones of the Palaearctic region and numerous *Tetramorium* species are widely distributed across the Pacific island systems.

The tribe also contains some of the world's more successful tramp species, spreading mainly or solely by means of human commerce. Such species are found in *Triglyphothrix* (*Tr. lanuginosa*, *Tr. kheperra*) and *Tetramorium* (*T. simillimum*, *T. guineense*, *T. pacificum*) and are more or less commonly encountered in the temperate zones of the world where they are capable of surviving in hothouses or permanently heated buildings, and over wide areas of the world tropics where they are quite at home in nests away from human habitation or in places where the ground has been disturbed by agriculture.

In the free-living genera the vast majority of species are terrestrial or subterranean, with very few arboreal forms. Ground nesting species characteristically nest directly in the earth, in rotten twigs, in or under rotten logs or in compressed leaf litter, and foraging is normally carried on at ground level. A few species which nest in the ground are not averse to foraging on the stems and leaves of plants or even on trees. Of the arboreal species the most common nest sites include rot-holes or rotten areas beneath the bark of otherwise healthy trees, but a few species build rough fibrous nests under leaves or in branch forks, such nests being constructed of vegetable fibres, small twigs and pieces of leaf. Colony size is usually moderate, with a few hundred workers, but in some *Rhoptromyrmex* the nests may be enormous.

Most tetramoriines are generalized predators or scavengers but a few are more specialized and tend homopterous insects or visit plant nectaries. A few species have very specialized diets, for example all members of the *Tetramorium sericeiventre*-group are suspected of feeding entirely on other ants, particularly *Pheidole* species.

Previous studies of the Tetramoriini as a tribe are confined to a few works on a regional basis, such as those of Forel (1902*b*) and Bingham (1903) of the Indian fauna, Arnold (1917; 1926) of the South African fauna, Creighton (1950) of the North American fauna and Mann (1919; 1921) of the species of the Solomon and Fiji Islands. Apart from these there have been a number of reviews or revisions of some of the smaller genera, and these are noted under the discussions of the genera in question.

MUSEUMS AND INSTITUTIONS

ANIC, Canberra	Australian National Insect Collection, Canberra City, Australia.
BMNH	British Museum (Natural History), London, U.K.
CAS, San Francisco	California Academy of Sciences, San Francisco, California, U.S.A.
IE, Bologna	Istituto di Entomolgià del'Universita, Bologna, Italy.
MCSN, Genoa	Museo Civico di Storia Naturale 'Giacomo Doria', Genoa, Italy.

MCSN, Verona	Museo Civico di Storia Naturale, Verona, Italy.
MCZ, Cambridge	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN, CdF	Muséum d'Histoire Naturelle, La Chaux-de-Fonds, Switzerland.
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva, Switzerland.
MNHN, Paris	Muséum National d'Histoire Naturelle, Paris, France.
MNHU, Berlin	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (D.D.R.).
MRAC, Tervuren	Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
NM, Basle	Naturhistorisches Museum, Basle, Switzerland.
NM, Bulawayo	National Museum, Bulawayo, Rhodesia.
NM, Hamburg	Naturhistorisches Museum, Hamburg, Germany.
NM, Vienna	Naturhistorisches Museum, Vienna, Austria.
UM, Oxford	University Museum, Oxford, U.K.
ZM, Munich	Zoologisches Sammlung des Bayerischen Staates, Munich, Germany.

MEASUREMENTS AND INDICES

Total Length (TL). The total outstretched length of the individual, from the mandibular apex to the gastral apex.

Head Length (HL). The length of the head proper, measured in a straight line from the anterior clypeal margin to the mid-point of the occipital margin, in full-face view.

Head Width (HW). The maximum width of the head behind the eyes, measured in full-face view.

Cephalic Index (CI).

$$\frac{HW \times 100}{HL}$$

Scape Length (SL). The straight-line length of the antennal scape excluding the basal constriction or neck.

Scape Index (SI).

$$\frac{SL \times 100}{HW}$$

Pronotal Width (PW). The maximum width of the pronotum in dorsal view.

Alitrunk Length (AL). The diagonal length of the alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the base of the metapleural lobes or teeth.

All measurements are expressed in millimetres.

GENERIC COMPOSITION AND ORIGINS OF TETRAMORIINI

The earliest attempts at defining a tribe Tetramoriini were quite vague as to its limits and a number of unrelated genera which were excluded later were originally grouped together. The situation as it had been reached in the first decade of this century was summarized by Wheeler (1910) under a tribal name of Tetramorii. Beside the presently-included genera this agglomeration also contained the genera *Mayriella* Forel, *Calyptomyrmex* Emery, *Meranoplus* F. Smith, *Wasmannia* Forel and *Ochetomyrmex* Mayr.

A serious attempt to define the tribe more accurately was made by Emery (1914*a*) in a paper which gave a preview of his later massive works in the *Genera Insectorum* series. He presented a key to the myrmicine tribes as he defined them, and further restricted the Tetramoriini by removing disparate genera such as those noted above. A number of other genera were listed as tetramoriine by Forel (1917) and the genera thus included were more or less stabilized in the dual classifications of Emery and Wheeler, both of which appeared in 1922.

The only difference between these two systems as regards the tetramoriines lay in the treatment of *Tetramorium aculeatum*, which was treated under *Tetramorium* by Emery but which had been removed by Wheeler (1920) to a separate genus, *Macromischoides*. Later Wheeler (1922) defined this genus and placed it in tribe Leptothoracini where it has been retained by most authors (myself included; Bolton, 1973) despite the proof by Santschi (1924) that *Macromischoides* belongs in the Tetramoriini.

As the Emery-Wheeler classification was emerging, Forel (1922) described *Tetramorium* subgenus *Cephalomorium*, the single species of which was shown later by Santschi (1925) to be a member of genus *Pheidole*.

Despite these works the limits of tribe Tetramoriini were still rather vague, and subsequent to the Emery-Wheeler classification various authors added genera and subgenera to the tribe until by 1950 (after the addition of the last generic name but before any critical studies were undertaken) the generic composition of the tribe was as follows.

- *Decamorium* Forel
- *Dyomorium* Donisthorpe
- *Eutetramorium* Emery
- *Ireneella* Donisthorpe
- *Ireneopone* Donisthorpe
- *Lundella* Emery
- *Macromischoides* Wheeler
- *Rhoptromyrmex* Mayr
  - *R.* subgen. *Acidomyrmex* Emery
- *Strongylognathus* Mayr
  - =*Myrmus* Schenk
- *Teleutomyrmex* Kutter
- *Tetramorium* Mayr
  - =*Tetrogmus* Roger
  - *T.* subgen. *Lobomyrmex* Kratochvil
  - *T.* subgen. *Sulcomyrmex* Kratochvil
- *Tetramyrma* Forel
- *Triglyphothrix* Forel
- *Xiphomyrmex* Forel

Since 1950 a number of modifications to this system have been suggested. Brown (1953) showed that *Lundella* was synonymous with *Hylomyrma* (tribe Myrmicini) and thus removed the Neotropical region's only claim to endemic tetramoriines (see also Kempf, 1973) and later Brown (1964) synonymized *Acidomyrmex* to *Rhoptromyrmex*. Ettershank (1966) showed that *Dyomorium* was a synonym of *Vollenhovia* and thus outside the Tetramoriini and he also pointed out that *Anergates* should be included in the tribe and not treated as a member of Solenopsidini or of a subtribe thereof, as had previously been the case (Emery, 1914*a*; 1922; Forel, 1917; Wheeler, 1922).

At generic level the results of the present study have confirmed the above suggestions and shown that *Eutetramorium*, *Ireneopone* and *Tetramyrma* are not tetramoriines; that *Ireneella* is a synonym of *Rhoptromyrmex* and that *Xiphomyrmex*, *Macromischoides*, *Lobomyrmex*, *Sulcomyrmex* and *Atopula* (from outside the tribe) are all synonyms of *Tetramorium*. These results are discussed in detail elsewhere in this study.

Thus the generic composition of the tribe is now as follows.

- ***Anergates*** Forel
- ***Decamorium*** Forel
- ***Rhoptromyrmex*** Mayr
  - *Acidomyrmex* Emery
  - *Ireneella* Donisthorpe **syn. n.**
- ***Strongylognathus*** Mayr
  - *Myrmus* Schenck
- ***Teleutomyrmex*** Kutter
- ***Tetramorium*** Mayr
  - *Tetrogmus* Roger
  - *Xiphomyrmex* Forel **syn. n.**
  - *Atopula* Emery **syn. n.**
  - *Macromischoides* Wheeler **syn. n.**
  - *T.* subgen. *Lobomyrmex* Kratochvil **syn. n.**
  - *T.* subgen. *Sulcomyrmex* Kratochvil **syn. n.**
- ***Triglyphothrix*** Forel

Amongst these seven genera *Tetramorium* is by far the largest, exceeding all the other genera combined in number of species. This is also the genus showing the least number of specialised characteristics and is most probably the stem from which the other genera originally radiated. It is difficult to make generalizations about such highly specialized forms as *Anergates* and *Teleutomyrmex*, but the other four genera cluster closely around *Tetramorium* and are obvious derivations from it, mainly through a process of reduction in characters (lower palp formula and antennomere count, reduced dentition, loss of cephalic and clypeal median carinae etc.) and only more rarely by the development of characters not seen in *Tetramorium* itself, such as branched hairs in *Triglyphothrix* and falcate mandibles in *Strongylognathus*.

Concerning the age of the tribe, Brown (1973) points out that the Tetramoriini may well be a recent group as it is unrepresented in any mid-Tertiary or earlier fossil deposits, whereas most other large myrmicine tribes, including nearly all those which have numerous living genera and species, are well represented or abundant in these deposits. Also, Tertiary fossil forms of numerous small myrmicine tribes are present in the deposits.

It can be argued that as the major Tertiary deposits which yield properly identifiable ants (as opposed to fragments or impressions) are in the form of amber, then only arboreal or subarboreal forms would be expected to occur in such locations, and as most tetramoriines are terrestrial or subterranean they would be excluded from such fossiliferous systems.

However, it is also true that the number of arboreal/subarboreal species of modern *Myrmica*, *Leptothorax* etc. are few when compared with the sizes of the genera as a whole but tree-dwelling forms have been represented throughout the history of these genera, and it is most probable that *Tetramorium* at least of the tetramoriines has as many arboreal/subarboreal forms as the other genera mentioned at the present time. It is difficult to envisage that if such forms were present in mid-Tertiary times they would not have been attracted to the resin oozing from the trees to the same extent as species from other genera. One is left with two possibilities: either the tetramoriines were scarce or absent at that time or they had not then developed arboreal species. In either case there remains the conclusion that the vast radiation of this tribe must have occurred since mid-Tertiary times as its members are now numerous or abundant throughout the Old World tropics and subtropics in all ecosystems, and are well represented in the southern Palaearctic region.

Wheeler (1914) was of the opinion that the members of the extinct Baltic amber genus *Nothomyrmica* resembled some species of *Tetramorium* but he did not include it in his section devoted to Tetramoriini, in which he actually placed *Parameranoplus*, *Stigmomyrmex* and *Enneamerus*, none of which are tetramoriine ants. I examined a Wheeler-determined specimen of *Nothomyrmica rudis* (Mayr) in MCZ, Cambridge and have reached the conclusion that the resemblances between this genus and the tetramoriines are superficial and do not indicate relationship. All this reinforces my belief that the tetramoriine radiation occurred after the formation of the Baltic amber deposits was concluded (i.e. post-Oligocene) and it is interesting to speculate upon whether the rise of the Tetramoriini was in any way responsible for the disappearance of earlier genera which originally occupied the environments now dominated by *Tetramorium* and its allies in the Old World tropics.

Concerning the relationships and derivation of the tribe as a whole it seems most probable, on grounds of habitus and morphology, that *Tetramorium* and *Myrmica* are descended from the same ancestral stock, and the more generalized leptothoracines also show similarities to these forms in construction of the body. Particularly interesting is the ease with which the relatively specialized dentitions of the leptothoracines and tetramoriines can be derived from the relatively generalized dentition of *Myrmica* in forms in which the general construction of the head and body are basically similar. In *Myrmica* the mandible has a long series of teeth which decrease in size from the apical to the basal and appear relatively unspecialized. In *Tetramorium* the number of teeth is usually less than in *Myrmica*, but not much less, and specialization has been achieved by reducing the basal series in size whilst maintaining the more apical 2–3 teeth as large. In generalized leptothoracines the trend has been towards a reduction in number of teeth rather than towards specialization of what is available, and the number of teeth has been reduced to a consistent count of five, in a decreasing size series from apex to base of the masticatory margin.

I consider the three tribes Myrmicini, Leptothoracini and Tetramoriini to be closely related and ultimately to have been derived from the same ancestral stock, which was most probably a creature closely resembling the modern genus *Myrmica*, but evidence proving or disproving this opinion is still very much incomplete.

Tribe **TETRAMORIINI** Wheeler

Tetramorii Wheeler, 1910 : 141. Type-genus: *Tetramorium* Mayr.
Tetramoriini Wheeler; Emery, 1914*a* : 38.

The definition of the tribe is rendered difficult by the presence in it of two degenerate, workerless parasitic species which occupy two monotypic genera and exhibit many of the changes listed by Wilson (1971) as the 'inquiline syndrome'.

Disregarding these two species for the moment the remaining vast majority may be diagnosed by the possession in combination of the characters noted below.

Diagnosis of worker and female Tetramoriini. Myrmicine ants in which:

1, either dentition of 2–3 teeth apically, followed by a row of 3–7 denticles; never with a graded series of teeth and never with fewer than 6 teeth; *or* mandibles edentate and falcate;
2, palp formula never exceeding 4, 3;
3, sting with an apical or apicodorsal lamelliform appendage of varying shape;
4, anterolateral portions of clypeus raised into a ridge or shield-wall in front of the antennal insertions.

Diagnosis of male Tetramoriini. Myrmicine ants in which:

1, antennae with second funicular segment an elongate fusion-segment usually consisting of 3–4 antennomeres;
2, mandible dentate or falcate and edentate.

DEFINITION. The following formal definition includes all members of the tribe.

Workers and females. Ants belonging to the subfamily Myrmicinae with thick, usually strongly sculptured integument. Mandibles usually triangular or subtriangular, the masticatory margin with 2–3 large teeth apically, followed by a series of 3–7 denticles, the most frequent dental arrangement being 3 teeth plus 4 denticles, but never with less than 6 in all. Exceptions to this occur in *Strongylognathus* where the mandibles are falcate and edentate, and in the workerless parasitic genera *Anergates* and *Teleutomyrmex* where the mandibles are edentate and reduced. Palp formula 4,3 at maximum, the vast majority of the tribe with this PF value but reductions to 4,2; 3,3; and 3,2 are known and in parasitic forms the PF is 1,1. Anterolateral portions of clypeus in front of the antennal insertions raised into an acute ridge or shield-wall which is confluent with the sides of the broad median portion of the clypeus as a ridge or sharp edge. This feature is a modification of the clypeus itself and is not merely the result of the impression of the head immediately posterior to the lateral parts of the clypeus. The ridge is eroded in *Decamorium* and reduced in *Anergates*.

Antennae 10, 11 or 12-segmented, the three apical antennomeres forming a club. Antennal scrobes often present, situated above the eyes. Ocelli present in females, absent in workers. Anterior lobes of frontal carinae widely separated, the distance across the lobes in a straight line up to twice the distance from the edge of the lobe to the genal margin in full-face view.

Most free-living species with a longitudinal cephalic carina running down the midline of the dorsum of the head and continued on the clypeus as a median clypeal carina. This character is reduced or absent in parasitic or dulotic forms and in some free-living species either the cephalic or the clypeal part of the carina may be absent, but it is rarely completely absent.

In workers the alitrunk without dorsal sutures although the metanotal groove is generally impressed (not in *Triglyphothrix*). Females always winged when virgin, the alitrunk with a full complement of flight sclerites. Wing venation as in males, discussed below. Propodeal spiracle circular or subcircular, the propodeum itself usually armed with a pair of spines or teeth but exceptions to this occur in most genera. Metapleural lobes present, often acute or dentiform but by no means universally so. Legs generally with the femora more or less swollen, and often with a single simple spur on each of the middle and hind tibiae, but these are reduced or absent in many species.

Petiole pedunculate, the node either squamiform or nodiform, subsessile only in the workerless parasitic forms; the node never armed with spines or teeth, never with a massive anteroventral process. Postpetiole very variable in shape. Sting well developed, with a lamelliform and translucent apical or apicodorsal appendage which may be spatulate, triangular, dentiform or pennant-shaped. Absent only in *Anergates* and *Teleutomyrmex* where the sting is reduced and non-functional.

Males. Amongst the Myrmicinae the tetramoriine males are defined by the following combination of characters.

Antennae 9-,10- or 11-segmented, the second funicular an elongate fusion-segment composed of 3–5 segments fused together. The usual antennomere count in the tribe is 10, the fusion-segment thus containing 4. Mandibles dentate except in *Strongylognathus* (falcate) and the workerless permanent social parasites where they are edentate and generally reduced. Palp formula as in worker/female. Eyes and ocelli present. Alitrunk with flight sclerites, all males winged except in *Anergates* where the male is pupoidal. Wing venation is remarkably stable throughout the tribe and marked reduction is shown only in *Teleutomyrmex* and *Anergates* female. The usual vein-pattern is illustrated in Text-figs 8, 16, 30, 41 and the reductions in Text-figs 23, 26. In *Anergates* female and *Teleutomyrmex*, *m-cu* cross-veins are variably present, usually being weak, incomplete or absent, but in the former *m-cu* is generally visible. In most species *cu-a* has shifted well back along *Cu* towards the wing-roots, but in *Anergates* female this shift is not so well marked as elsewhere in the tribe.

Mesoscutum and scutellum strongly developed, in profile the former overhanging the pronotum. Notauli usually present, at least with the anterior arms of the Y-shape visible, more rarely the notauli very reduced or absent. Parapsidal grooves present or absent. Genitalia usually partially retractile, more rarely apparently fully retractile. Gonopalpi present.

GENERA NEWLY EXCLUDED FROM TETRAMORIINI

TETRAMYRMA Forel

Tetramyrma Forel, 1912*d* : 766 [as subgenus of *Dilobocondyla*]. Type-species: *Dilobocondyla* (*Tetramyrma*) *braunsi* Forel, op. cit.: 767; by monotypy.

Tetramyrma Forel; Forel, 1913*a* : 122. [Raised to genus.]

Tetramyrma Forel; Emery, 1914*a* : 42. [Transferred to Tetramoriini.]

There is little doubt that Forel's original placement of *Tetramyrma* outside the Tetramoriini was more accurate than Emery's (1914*a*) later transfer of this genus into the tribe, although it has since been retained there without question by later authors such as Wheeler (1922). On the present evidence the genus is certainly to be excluded from any further consideration of tetramoriine ants as both the included species lack all the basic tetramoriine characteristics. The palp formula is 5,3; the mandibles have five teeth in a decreasing-size series from apex to base; the sting lacks a lamelliform appendage apically and the clypeus is not raised into a ridge in front of the antennal insertions.

On the present evidence *Tetramyrma* shows affinities with the Ethiopian region species of *Leptothorax* in the construction of the head in general and the clypeus in particular, as this has a projecting, arcuate anterior margin which overlaps the base of the mandibles. On the other hand the metanotal groove is deeply impressed, a feature not encountered in other African *Leptothorax*. However, in overall appearance *T. braunsi* bears a striking resemblance to members of the *Leptothorax anacanthus*-group. I have examined a syntype of *L. maximus* (in MCZ, Cambridge) and compared it directly to the specimens of *T. braunsi* available; the similarities are obvious and it may be necessary to ask whether *Tetramyrma* can retain its identity or must be sunk as a synonym of *Leptothorax*.

In view of the above *Tetramyrma* is transferred for the time being into the tribe Leptothoracini, until its relationships can be studied in more detail. The species affected are as follows.

Tetramyrma braunsi (Forel)

Dilobocondyla (*Tetramyrma*) *braunsi* Forel, 1912*d* : 767. Holotype worker, South Africa: Cape Colony, Willowmore (*Brauns*) (BMNH) [examined].
Tetramyrma braunsi (Forel); Forel, 1913*a* : 122 et auctt.

Tetramyrma simoni (Emery)

Tetramorium simoni Emery, 1895*a* : 35, pl. 2 fig. 22. LECTOTYPE worker, South Africa: Transvaal, Makapan (*E. Simon*) (MCSN, Genoa), here designated [examined].
Tetramyrma simoni (Emery); Emery, 1922 : 291.

The two species are very closely related but in *simoni* the propodeum is armed with a pair of teeth which are absent in *braunsi*.

IRENEOPONE Donisthorpe

Ireneopone Donisthorpe, 1946*b* : 242. Type-species: *Ireneopone gibber* Donisthorpe, loc. cit; by original designation.

One of the seven ant species known to be endemic on the island of Mauritius (Brown, 1974), this odd monotypic genus was placed in the Tetramoriini by Donisthorpe without him giving any reasons for the placement. In fact many of the characters cited in the original description militate against the inclusion of *Ireneopone* in this tribe.

The mandibles have five teeth, regularly decreasing in size from apex to base (not three as stated in the original description; the two basals are concealed by the clypeus in the holotype but are visible in the single surviving paratype). Palp formula 5,3 (as opposed to 4,3 maximum in tetramoriines). Clypeus and head capsule without median longitudinal carinae. Lateral portions of clypeus not raised into a shield in front of the antennal insertions but the area below the insertions locally depressed behind the lateral parts of the clypeus. Sting without a lamelliform appendage apically.

Ireneopone gibber Donisthorpe

Ireneopone gibber Donisthorpe, 1946*b* : 242, figs 1, 2. Holotype and paratype workers, Mauritius: Calebasses Mt., 22.x.1944, no 72 (*R. Mamet*); and Le Pouce Mt., 7.xii.1940 (*J. Vinson*) (BMNH) [examined].

Having shown that *Ireneopone* does not belong in the Tetramoriini, the problem is now to find its correct tribal placement. For the present I propose to transfer this genus to the tribe Myrmecinini, close to the complex of small genera centring on *Arataner*. The reason for this is that, besides having the characters given above, *Ireneopone* has the antennal insertions widely separated, the clypeus strongly inserted between them. The mesonotum is delimited by a raised portion in front and an impressed metanotal groove behind. The propodeum is unarmed and rounded metapleural lobes are present. The petiole has a long anterior peduncle and a low, narrow node which is rounded-subconical in profile and with a short posterior peduncle.

It is by no means claimed that this is the last word on the placement of this peculiar species; the final decision must await a revisionary study of the myrmecinine genera.

EUTETRAMORIUM Emery

Eutetramorium Emery, 1899 : 280. Type-species: *Eutetramorium mocquerysi* Emery, op. cit.: 281; by subsequent designation of Wheeler, 1911 : 163.

Since its description *Eutetramorium* has apparently always been treated as a *bona fide* member of tribe Tetramoriini, throughout all the varying concepts of this tribe (Wheeler, 1910; 1922; Emery, 1914*a*; 1922; Forel, 1917). The only reason for this appears to be the fact that the clypeus is raised laterally, in front of the antennal insertions. Other tetramoriine characters are lacking excepting the palp formula which has a typically tetramoriine count of 4,3. However, the basal segments of both palpi are very long and appear to be the result of the fusion of several shorter palpomeres (paralectotype of *E. mocquerysi* dissected). The critical lamelliform sting appendage is lacking, as is the differentiated tetramoriine dentition. I am presently of the opinion that *Eutetramorium* is better placed in the tribe Myrmicini as, beside the fact that the tibial spurs of the middle and hind legs are minutely barbulate or serrated, the general appearance of the head capsule, alitrunk and pedicel is very close to the *rugosa*-like species of *Myrmica* of the Oriental and south-eastern Palaearctic regions, some of which also have the lateral portions of the clypeus raised into a shield in front of the antennal insertions.

Both known species of this small genus are from Madagascar.

Eutetramorium mocquerysi Emery

Eutetramorium mocquerysi Emery, 1899 : 281, fig. LECTOTYPE and paralectotype workers, MADAGASCAR: Antongil, 1897–1898 (*A. Mocquerys*) (MCSN, Genoa), here designated [examined].

Eutetramorium monticellii Emery

Eutetramorium monticellii Emery, 1899 : 283. Syntype worker and female, MADAGASCAR: Antongil, 1897–1898 (*A. Mocquerys*) (MCSN, Genoa) [examined].

SPECIES NEWLY EXCLUDED FROM TETRAMORIINI

ROMBLONELLA Wheeler

Romblonella Wheeler, 1935 : 5. Type-species: *Romblonella grandinodis* Wheeler, op. cit.: 7 [= *Myrmica opaca* F. Smith, 1861 : 47]; by original designation.

A small and somewhat obscure genus of ants belonging to the tribe Meranoplini, which contains some seven species. On original description the genus was monotypic and, during the course of this study, it was discovered that *Tetramorium opacum* is in fact the senior synonym of the type-species of *Romblonella*. What is known of the genus is summarised in M. R. Smith (1953 : 1956), and this remains unchanged except for the following, which is now confirmed.

Romblonella opaca (F. Smith) **comb. n.**

Myrmica opaca F. Smith, 1861 : 47. Holotype worker, SULAWESI: Tondano (*A. R. Wallace*) (UM, Oxford) [examined].
Tetramorium opacum (F. Smith); Donisthorpe, 1932 : 469
Romblonella grandinodis Wheeler, 1935 : 7, fig. 2. Syntype workers, PHILIPPINES: Romblon I., 6.v.1928 (*L. Marato*) (MCZ, Cambridge) [examined]. **Syn. n.**

CHELANER Emery

Chelaner Emery, 1914*b* : 410 [as subgenus of *Monomorium*]. Type-species: *Monomorium* (*Chelaner*) *forcipatum* Emery, loc. cit.; by subsequent designation of Emery, 1922 : 168.
Chelaner Emery; Ettershank, 1966 : 93. [Raised to genus.]

Chelaner flavigaster (Clark) **comb. n.**

Xiphomyrmex flavigaster Clark, 1938 : 366, fig. 5. Syntype workers, AUSTRALIA: Sir Joseph Banks Islands, Reevesby I. (ANIC, Canberra.)

From Clark's original description it is obvious that *flavigaster* is not a tetramoriine, but its correct generic placement is difficult. For the identification of this species as a member of genus *Chelaner* I am indebted to Dr R. W. Taylor of ANIC, Canberra, who kindly examined the relevant type-material for me.

KEYS TO GENERA OF TETRAMORIINI

Workers

1 Mandibles narrow and falcate, edentate or at most with a single minute denticle close to the apex (Text-figs 13, 14) (Palaearctic) . ***STRONGYLOGNATHUS*** (p. 304)
– Mandibles triangular or subtriangular, dentate, with two or three enlarged teeth apically followed by a series of 3–7 denticles 2
2 Some or all dorsal surfaces of head and body equipped with branched hairs which may be bifid, trifid or quadrifid, simple hairs often also present. Metanotal groove in profile not impressed. (Old World Tropics, but no known endemics in Australia or Madagascar) . . . . ***TRIGLYPHOTHRIX*** (p. 310)
– Dorsal surfaces of head and body without bifid, trifid or quadrifid hairs; simple hairs usually present but some species with bizarre pilosity and some hairless. Metanotal groove often impressed 3
3 Antennae with 10 segments (Ethiopian) . . . . . ***DECAMORIUM*** (p. 297)
– Antennae with 11 or 12 segments 4
4 Palp formula 3,2. Head roughly heart-shaped (Text-figs 1–3) with sides convex and

occiput concave, the head narrowing anteriorly. Median portion of clypeus with a prominent, arcuate anterior margin which overlaps the basal angle of the mandible. Median clypeal and median cephalic carinae vestigial or absent. (Old World Tropics) . . . . ***RHOPTROMYRMEX*** (p. 298)

– Palp formula usually 4,3, very rarely reduced (one species known with PF 3,2). Head not heart-shaped. Median portion of clypeus with anterior margin not prominent, not overlapping the basal angle of the mandible. Usually both the median clypeal and median cephalic carinae present, more rarely with one or the other absent, very rarely with both absent. (Worldwide but with no Neotropical endemics, one Nearctic endemic). . . . . ***TETRAMORIUM*** (p. 359)

Females (Queens)

1 Mandibles dentate, armed with 2–3 enlarged apical teeth followed by a row of 3–7 denticles 2

– Mandibles edentate, either falcate or reduced 5

2 Branched hairs present on some or all surfaces of the head, alitrunk, pedicel and gaster, either bifid, trifid or quadrifid . . . ***TRIGLYPHOTHRIX*** (p. 310)

– Branched hairs absent, simple hairs usually present although in some species pilosity is bizarre or absent 3

3 Antennae with 10 segments . . . . . . ***DECAMORIUM*** (p. 297)

– Antennae with 11 or 12 segments 4

4 Palp formula 3,2. Median portion of clypeus with a prominent, arcuate anterior margin which overlaps the basal angle of the mandible. Median clypeal and median cephalic carinae vestigial or absent . . ***RHOPTROMYRMEX*** (p. 298)

– Palp formula usually 4,3, rarely less. Median portion of clypeus without a prominent, arcuate anterior margin which overlaps the basal angle of the mandible. Median clypeal and median cephalic carinae usually present, sometimes one or the other absent, rarely with both absent . . . . . ***TETRAMORIUM*** (p. 359)

5 Anterior clypeal margin deeply emarginate or notched medially (Text-fig. 19). (Palaearctic, Nearctic) . . . . ***ANERGATES*** (p. 296)

– Anterior clypeal margin entire, not deeply emarginate or notched medially . . 6

6 Mandibles falcate; palp formula 4,3. Postpetiole not broadly attached to first gastral tergite, gaster not dorsoventrally flattened. Sting present, with an apicodorsal appendage. Worker caste present . . . ***STRONGYLOGNATHUS*** (p. 304)

– Mandibles blade-like (Text-fig. 24); palp formula 1,1. Postpetiole very broadly attached to first gastral tergite, gaster strongly dorsoventrally flattened. Sting reduced and non-functional, without apicodorsal appendage. Worker caste absent. (Palaearctic). . . . . ***TELEUTOMYRMEX*** (p. 309)

Males

1 Mandibles edentate, either reduced or reduced-falcate 2

– Mandibles dentate 4

2 Pupoidal and apterous. Anterior clypeal margin deeply emarginate or notched medially . . . . ***ANERGATES*** (p. 296)

– Winged, body fully developed or somewhat pupoidal. Anterior clypeal margin not emarginate or notched medially 3

3 Mandibles short-falcate; palp formula 4,3. Gaster not downcurved, not reflexed anteriorly at the apex . . . . . . ***STRONGYLOGNATHUS*** (p. 304)

– Mandibles blade-like and very reduced; palp formula 1,1. Gaster downcurved and somewhat reflexed anteriorly at the apex. . . ***TELEUTOMYRMEX*** (p. 309)

4 Some or all dorsal surfaces of head, alitrunk, pedicel and gaster with branched bifid, trifid or quadrifid hairs . . . . ***TRIGLYPHOTHRIX*** (p. 310)

– Branched hairs absent; simple hairs usually present but bizarre pilosity present in some species 5

5 Antennae basically 9-segmented, the three apical funicular segments enlarged or definitely incrassate. Palp formula 3,2 . . . ***RHOPTROMYRMEX*** (p. 298)

– Antennae 10 or 11-segmented, the funicular segments filiform, not incrassate apically. Palp formula usually 4,3 ***TETRAMORIUM*** (p. 359) and ***DECAMORIUM*** (p. 297)

ANERGATES Forel

(Text-figs 19–23)

Anergates Forel, 1874 : 32. Type-species: *Myrmica atratula* Schenck, 1852 : 91; by monotypy.

Diagnosis. *Female.* Mandibles reduced, edentate except for the apical tooth. Palp formula 1,1 (Ettershank, 1966, here confirmed), the palps reduced. Clypeus with its median anterior margin broadly and deeply emarginate. Antennae 10- or 11-segmented with a variable degree of fusion of the second to fourth funicular antennomeres (at arrow in Text-fig. 19). Ocelli present (Text-fig. 19). Alitrunk with full set of flight sclerites, the virgin females winged (Text-fig. 23). Postpetiole strongly expanded, broadly attached to gaster (Text-fig. 21). Gaster in virgin females with a broad and deep longitudinal furrow or impression; mature females strongly physogastric. Sting strongly reduced, non-functional.

Male. Pupoidal and apterous. Mandibles lobiform, edentate, not capable of full closure (Text-fig. 20). Palp formula 1,1 as in female. Median anterior clypeal margin broadly and deeply emarginate. Antennae 10- or 11-segmented, the third funicular antennomere variably fused with the fourth (Text-fig. 20). Second funicular segment usually quite long when compared to those just distal to it and apparently is a shortened fusion-segment. Ocelli present. Alitrunk with flight sclerites but wings never developed. Petiole and post-petiole strongly anteroposteriorly compressed, roughly thick-disciform in shape and each very broadly attached to the following segment (Text-fig. 22). Apex of gaster reflexed ventrally. Genitalia large, strongly extruded.

The single species belonging to this genus, *A. atratulus*, is a degenerate, workerless, permanent social parasite in nests of *Tetramorium caespitum.* Emery (1922) placed *Anergates* in a subtribe Anergatini of tribe Solenopsidini, but Ettershank (1966), in his revision of the solenopsidine genera, excluded *Anergates* and suggested that the genus should be transferred to Tetramoriini on the grounds of its reduced antennal segmentation, wing venation and close parasitic association with *Tetramorium.* I am in agreement with this suggestion and believe that *Anergates* is developed from a *T. caespitum*-like ancestor although its origins can probably never be traced with certainty because of the many morphological adaptations made by this species in response to its parasitic lifeway. Wilson (1971) has listed 19 such characteristic adaptations of parasitic ants which he terms the 'inquiline syndrome', many of which apply to *Anergates*.

What is known of the biology of *Anergates* is summarised in Wheeler (1910), Creighton (1950), Kutter (1969), Wilson (1971) and their included references.

Anergates atratulus (Schenck)

Myrmica atratula Schenck, 1852 : 91. Syntype female, male, Germany (West): Nassau distr., NW. of Franfurt (*Schenck?*) (types possibly in MNHU, Berlin).

Anergates atratulus (Schenck); Forel, 1874 : 32.

Anergates friedlandi Creighton, 1934 : 193. Holotype female, U.S.A.: New Jersey, side of U.S. Highway 9, 3 miles N. of Englewood, 31.v.1932 (*S. Friedland*) (probably in MCZ, Cambridge, originally in Creighton private coll.). [Synonymy by Creighton, 1950.]

A. atratulus is distributed throughout Europe within the range of its host species and is also known from Ukraine and the U.S.A. from Connecticut to N. Virginia. To the best of my knowledge it has never yet been recorded outside the nests of its host although there is little doubt that the alate females fly when searching for new host colonies.

DECAMORIUM Forel

(Text-figs 27–31)

Decamorium Forel, 1913*a* : 121 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Decamorium*) *decem* Forel, loc. cit.; by monotypy.
Decamorium Forel; Emery, 1914*a* : 42. [Raised to genus.]

DIAGNOSIS. *Worker*. Mandibles armed with three teeth plus a series of 4–5 denticles; alternate members of the denticle series enlarged, in some cases with denticles doubled (Text-fig. 28). Palp formula 4,3 (dissections of *decem* and *uelense*). Antennae with 10 segments. Median longitudinal carina of clypeus absent, but present on dorsum of head capsule. Lateral raised portions of clypeus eroded and very reduced. Antennal scrobes strongly developed, with a marked dorsal margin but very poorly demarcated ventrally, median carina of scrobes absent (Text-fig. 27). Metanotal groove impressed; propodeum armed with a pair of short spines (Text-fig. 31). Apical lamelliform appendage of sting triangular, situated apicodorsally.

Female. As worker but with ocelli and flight sclerites; winged when virgin (Text-fig. 30).

Male. As *Tetramorium*.

This small genus contains only two species, is restricted to the Ethiopian region, and is but dubiously maintained as separate from *Tetramorium* on the grounds of the reduced antennal segmentation, reduced clypeal shield and the modified dentition in workers and females. In the long run none of these characters may be sufficient to keep *Decamorium* as a genus, for as can be seen, other genera in this tribe show variation in antennomere count; but at present no linking species between *Decamorium* and *Tetramorium* are known.

Of the two species, *decem* is reported by Arnold (1917) as forming quite large colonies in sandy soil, whereas *uelense* nests in twigs in leaf litter and humus and appears to form only small colonies. The habits of *decem* are not known but I have observed *uelense* in western Nigeria raiding a small subterranean termite colony in open woodland. The workers of *uelense* were leaving their nest (in a rotten twig) early in the morning and progressing in single file to the termite colony which was a few yards away. They moved through the leaf-litter and over a rotten branch in single file, almost nose to tail.

The two species of *Decamorium* are separated in the worker cast as follows.

1 Dorsum of promesonotum strongly and distinctly longitudinally striate, usually with scattered punctures also. (Ghana, Nigeria, Guinea, Zaire) . . . . ***uelense***
– Dorsum of promesonotum smooth and shining, with scattered punctures. (Rhodesia, Gabon, Ghana) . . . . ***decem***

SYNONYMIC LIST OF SPECIES

decem (Forel).
decem var. *ultor* Forel **syn. n.**
uelense Santschi **stat. n.**
decem subsp. *nimba* Bernard **syn. n.**

SUMMARY OF THE SPECIES

Decamorium decem (Forel)

(Text-figs 27–31)

Tetramorium (*Decamorium*) *decem* Forel, 1913*a* : 121. Syntype workers, RHODESIA: Redbank, 7.iv.1912 (*G. Arnold*) (BMNH; MHN, Geneva) [examined].

Decamorium decem (Forel); Emery, 1914*a* : 42. [Implied in text.]

Tetramorium (*Decamorium*) *decem* var. *ultor* Forel, 1913*b* : 217. Syntype workers, RHODESIA: Shiloh, 12.v.1913 (*G. Arnold*) (BMNH; MHN, Geneva) [examined]. **Syn. n.**

Decamorium uelense (Santschi) **stat. n.**

Tetramorium (*Decamorium*) *decem* st. *uelense* Santschi, 1923 : 285. Syntype worker, female, ZAIRE: Uelé, Vankerkhovenville (*Degreef*) (NM, Basle; MRAC, Tervuren) [examined].

Decamorium decem subsp. *nimba* Bernard, 1952 : 250. Holotype worker, GUINEA: Savane de Kéoulenta, st. 1 (*Lamotte*) (MNHN, Paris) [examined]. **Syn. n**

RHOPTROMYRMEX Mayr

(Text-figs 1–12)

Rhoptromyrmex Mayr, 1901 : 18. Type-species: *Rhoptromyrmex globulinodis* Mayr, op. cit.: 20; by subsequent designation of Wheeler, 1911.

Acidomyrmex Emery, 1915*b* : 191 [subgenus of *Rhoptromyrmex*]. Type-species: *Rhoptromyrmex wroughtonii* Forel, 1902*a* : 231; by original designation. [Synonymy by Brown, 1964.]

Ireneella Donisthorpe, 1941 : 175. Type-species: *Ireneella papuensis* Donisthorpe, loc. cit.; by original designation. **Syn. n.**

DIAGNOSIS. *Worker*. Head including mandibles roughly heart-shaped in full-face view (Text-figs 1–3), with the sides strongly convex, the occipital margin concave and the head capsule much broader behind than in front. Anterior margin of median portion of clypeus projecting and broadly arcuate. Antennal scrobes absent. Median longitudinal cephalic carina vestigial (indistinguishable from surrounding sculpture) or absent. Antennae 11- or 12-segmented, the apical three forming a club. Mandibles with two apical teeth, a much smaller third tooth and a row of 4–6 denticles. Palp formula 3,2 (dissections of *melleus*, *wroughtonii*, *critchleyi*, *globulinodis*, *opacus*, *transversinodis*; see also Brown, 1964). Metanotal groove impressed, but only very feebly so in some specimens. Propodeum armed with a pair of spines in Oriental and Indo-Australian species, unarmed in those from the Ethiopian region (Text-figs 9, 10) except in *critchleyi* (Text-fig. 12). Ventral surface of petiole generally longitudinally keel-like and convex. Sting with a triangular or dentiform lamelliform appendage apicodorsally.

Female. Adapted for a (presumed) temporary social-parasitic lifeway. Generally details of antennal segmentation, palp formula, dentition and sting structure as in worker but in one or two species the mandibles modified towards a falcate condition or otherwise reduced.

Alitrunk usually compressed from side to side, narrow and deep in dorsal view but retaining a full set of flight sclerites, and winged when virgin (Text-figs 4, 5).

Male. Antennae basically nine-segmented, the second funicular being an elongate fusion-segment (Text-figs 6, 7). Partial freeing of the apical member of this fusion-series or partial fusion of the next antennomere may give an ambiguous count of 8, 9 or 10 segments in some specimens. Rarely the limits of the fused segments are all visible. The three apical antennomeres tend to be enlarged and are distinctly incrassate in Oriental and Indo-Australian species. Palp formula 3,2 as in worker (dissections of *melleus*, *globulinodis*, *transversinodis*). Notauli weakly developed or absent. Radial cell in forewing open or closed.

Rhoptromyrmex is a small genus of tetramoriine ants containing only six species, four of which occur in the Ethiopian region and the other two distributed in the Oriental and Indo-Australian regions. The workers are typically tetramoriine in most of their characters but have developed away from their basal stock (believed to be in *Tetramorium*) by developing the characteristic head shape seen in this genus and by the accompanying loss of antennal scrobes, reduction of palp segmentation and virtual or complete disappearance of the cephalic median carina.

Emery (1915*b*; 1922) separated a subgenus *Acidomyrmex* to include the two Oriental and Indo-Australian species, solely on the grounds that the propodeum is armed in the workers of these two species, whereas it was unarmed in the then-known workers of Ethiopian region species. Brown (1964) pointed out that the size of the propodeal spines was very variable in *wroughtonii* and that the female of *melleus* has the propodeum unarmed, whereas in the African species the propodeal armament is strongly developed in females of *transversinodis* (and in workers of the new species, *critchleyi*). To define a subgenus on a character which only the worker shows, and which is demonstrably variable in one species, seemed unrealistic and *Acidomyrmex* was placed in synonymy. The discovery of *critchleyi*, a species from Nigeria which has propodeal spines present, further validates Brown's conclusion.

The females of *Rhoptromyrmex* (Text-figs 4, 5) are either aberrant or very aberrant, and Brown (1964) points out that many of their modifications resemble those shown in other species which are known to be temporary social parasites. Whether this theory is correct still remains to be seen as *Rhoptromyrmex* plus host colonies remain unknown.

The males are again typically tetramoriine, being specialised only in their reduced palp formula and antennal segmentation, which is basically of nine antennomeres here as opposed to ten in the remainder of the tribe (Text-figs 6, 7). The males of five species are now known as the single member of the monotypic genus *Ireneella* appears to be the male of *melleus*. Donisthorpe (1941) distinguished his genus *Ireneella* from other tetramoriines on the following characters:

1, antennae with nine segments;
2, palp formula 3,2 (confirmed in present study);
3, notauli absent;
4, mesonotum not overhanging pronotum;
5, ocelli smaller;
6, antennae not filiform apically (i.e. they are clavate);

7, petiole is 'differently formed';
8, radial cell in forewing is open.

Disregarding those characters which are known to be variable within this tribe (numbers 5, 7, 8), what remains is virtually a characterisation of the males of genus *Rhoptromyrmex*. Comparison of the types of *I. papuensis* with males of other *Rhoptromyrmex* species confirmed the synonymy of *Ireneella* within *Rhoptromyrmex*. Further, the very close resemblance between the males constituting the type-series of *I. papuensis* and those of *wroughtonii* (the two are separated only on details of sculpture) leads me to believe that *papuensis* is in fact the male of *melleus*, previously unknown. Circumstantial evidence in favour of this assumption and weighing against *papuensis* being merely a more heavily sculptured male of *wroughtonii* than was previously known lies in the fact that *melleus* is known mainly from New Guinea, the locality of *papuensis*, whilst the range of *wroughtonii* is not known to extend to that island. I feel sure that the association of *papuensis* with *melleus* is valid, and that further collections of worker-associated *melleus* males will confirm this synonymy.

Nests of *Rhoptromyrmex* species may be very large and are made directly into the soil or under stones. Brown (1964) gives biological notes on some species and states that they are 'general feeders, the ants collect living and dead arthropods, tend homopterous insects for their honeydew both above and below ground, and feed at plant nectaries'.

SYNONYMIC LIST OF SPECIES

***critchleyi* sp. n.**
globulinodis Mayr
    globulinodis st. *alberti* Forel
    globulinodis var. *obscurus* Santschi
melleus (Emery)
    papuensis Donisthorpe **syn. n.**
opacus Emery
    opacus var. *esta* Forel
    opacus var. *laeviceps* Santschi
    opacus subsp. *monodi* Bernard
transversinodis Mayr
    steini Forel
    transversinodis var. *pretoriae* Arnold
wroughtonii Forel
    wroughtonii st. *rothneyi* Forel
    wroughtonii st. *rothneyi* var. *longi* Forel
    rothneyi var. *intermedia* Forel
    rothneyi st. *sumatrensis* Forel
    rothneyi subsp. *leno* Viehmeyer
    rothneyi var. *taivanensis* Wheeler

All the above synonymy, with the exception of *melleus* = *papuensis*, is from the recent revision of *Rhoptromyrmex* by Brown (1964). Besides the above Brown also removed a number of species originally described in *Rhoptromyrmex* and transferred them as follows.

Rhoptromyrmex tessmanni Forel, 1910*b* : 421; transferred to *Macromischoides* as a synonym of *M. africanus* (Mayr) [now in *Tetramorium*].
Rhoptromyrmex solleri Forel, 1910*b* : 430; transferred to *Monomorium* Mayr.
Rhoptromyrmex mayri Forel, 1912*c* : 57; transferred to *Hagioxenus* Forel.

KEY TO SPECIES

(Workers)

(based on Brown, 1964)

1 Propodeum armed with a pair of spines or teeth (Text-figs 11, 12) 2
– Propodeum rounded, unarmed (Text-figs 9, 10) 4
2 Antennae with eleven segments (Nigeria) . . . . **critchleyi** (p. 303)
– Antennae with twelve segments (Indo-Australian and Oriental regions) 3
3 Propodeal spines very long, about twice as long as the distance between the centres of their bases (Text-fig. 11) and just about as long as the maximum width of the pronotum. Sculpture of head predominantly finely and densely reticulate-punctate, longitudinal costulae obsolete or few and weak. (New Guinea; Australia: N. Cape York Peninsula) . . . . **melleus**
– Propodeal spines variable in length but less than twice as long as the distance between the centres of their bases, and shorter than the pronotal width. Head and usually also the alitrunk with fine, close longitudinal costulation prominent in the sculpture. (Nepal, India, Burma, Thailand, S. China, Taiwan, Philippines, Borneo, Malaya, Sumatra, Java, Sumba, Australia: Cape York peninsula) . . . **wroughtonii**
4 Alitrunk and usually also the head with dense, opaque reticulate-punctate sculpture throughout. (Guinea, Uganda, Cameroun, Zaire) . . . . . . **opacus**
– Head and alitrunk in large part smooth and shining (mainly southern Africa) . . 5
5 Postpetiole subglobular, in dorsal view up to about 1·5 times broader than long (Text-fig. 9); in profile with a prominent rounded ventral protuberance. (Zaire, Rhodesia, South Africa) . . . . **globulinodis**
– Postpetiole transversely subrectangular, about twice broader than long (Text-fig. 10); in profile without a prominent ventral protuberance. (Rhodesia, South Africa) **transversinodis**

SUMMARY OF THE SPECIES

As the genus has been fully revised (Brown, 1964) full descriptions are not included here, but a summary of the species, their distribution and synonymy is given.

INDO-AUSTRALIAN AND ORIENTAL REGIONS.

THE *MELLEUS*-GROUP

Rhoptromyrmex melleus (Emery)

(Text-figs 2, 11)

Tetramorium melleum Emery, 1897 : 586, pl. 15, figs 29, 30. Holotype worker, NEW GUINEA: Belaio Island, near Friedrich-Wilhelmshafen (= Madang) (*L. Biro*) (HNM, Budapest).

Rhoptromyrmex (*Acidomyrmex*) *melleus* (Emery); Emery, 1922 : 290.
Ireneella papuensis Donisthorpe, 1941 : 175. Holotype and paratype males, NEW GUINEA: Papua, Mafula, 4000 ft, xii.1933 (*L. E. Cheesman*) (BMNH) [examined]. **Syn. n.** [See under discussion of genus.]

Distribution. New Guinea and Cape York Peninsula, Australia.

Rhoptromyrmex wroughtonii Forel

(Text-fig. 7)

Rhoptromyrmex wroughtonii Forel, 1902*a* : 231. Syntype workers, male, INDIA: Kanara (*Wroughton*) (MHN, Geneva).
Rhoptromyrmex wroughtonii st. *rothneyi* Forel, 1902*a* : 232. Syntype workers, INDIA: Bangalore (*Rothney*) (MHN, Geneva). [Synonymy by Brown, 1964.]
Rhoptromyrmex wroughtonii st. *rothneyi* var. *longi* Forel, 1902*a* : 232. INDIA: Assam, Garo Hills (MHN, Geneva). [Synonymy by Brown, 1964.]
Rhoptromyrmex rothneyi var. *intermedia* Forel, 1913*c* : 80. Syntype workers, SUMATRA: Beras Tagi, 4500 ft (*Buttel-Reepen*) (MHN, Geneva). [Synonymy by Brown, 1964.]
Rhoptromyrmex rothneyi st. *sumatrensis* Forel, 1913*c* : 80, fig. W. Syntype workers, SUMATRA: Kampong Keling, near Beras Tagi, 4500 ft (*Buttel-Reepen*) (MHN, Geneva). [Synonymy by Brown, 1964.]
Rhopthromyrmex [sic] *rothneyi* subsp. *leno* Viehmeyer, 1914 : 113. Holotype worker, WEST MALAYSIA: Perak (*E. Streesemann*) (location of type not known). [Synonymy by Brown, 1964.]
Rhoptromyrmex (*Acidomyrmex*) *rothneyi* var. *taivanensis* Wheeler, 1930 : 103. Syntype workers, TAIWAN: Hakumo (*R. Takahashi*) (MCZ, Cambridge). [Synonymy by Brown, 1964.]

Distribution. India, Thailand, S. China, Philippines, Taiwan, Malaya, Indonesia to Sumba, Australia: Cape York Peninsula.

ETHIOPIAN REGION.

THE *GLOBULINODIS*-GROUP

Rhoptromyrmex globulinodis Mayr

(Text-figs 1, 4, 6, 9)

Rhoptromyrmex globulinodis Mayr, 1901 : 20. Syntypes workers, female, male, SOUTH AFRICA: Port Elizabeth (NM, Vienna; BMNH) [examined].
Rhoptromyrmex globulinodis st. *alberti* Forel, 1916 : 419. Syntype workers, ZAIRE (*Kohl*) (MHN, Geneva). [Synonymy by Brown, 1964.]
Rhoptromyrmex globulinodis var. *obscurus* Santschi, 1932 : 339. Syntype workers, male, RHODESIA: Vumba Mts, Cloudland, 6000 ft, iv. 1923 (*G. Arnold*) (NM, Basle). [Synonymy by Brown, 1964.]

Distribution. Zaire, Rhodesia, South Africa.

Rhoptromyrmex opacus Emery

Rhoptromyrmex opacus Emery *in* Forel, 1909 : 59 (footnote). Syntype workers, CAMEROUN (*Conradt*) (MCSN, Genoa).

Rhoptromyrmex opacus var. *esta* Forel, 1909 : 59. Syntype workers, females, males, ZAIRE: Bas Congo (BMNH; MHN, Geneva) [examined]. [Synonymy by Brown, 1964.]

Rhoptromyrmex opacus var. *laeviceps* Santschi, 1916 : 504. Holotype worker, ZAIRE: Boma (*Bondroit*) (NM, Basle). [Synonymy by Brown, 1964.]

Rhoptromyrmex opacus subsp. *monodi* Bernard, 1952 : 251, fig. 14F. Holotype worker, GUINEA: Mt Nimba, Ziéla, st. F 32, savane (*Lamotte*) (location of holotype not known). [Synonymy by Brown, 1964.]

Distribution. Guinea, Uganda, Cameroun, Zaire.

Rhoptromyrmex transversinodis Mayr

(Text-figs 5, 8, 10)

Rhoptromyrmex transversinodis Mayr, 1901 : 22. Syntype workers, SOUTH AFRICA: Port Elizabeth (NM, Vienna; BMNH) [examined].

Rhoptromyrmex steini Forel, 1913*a* : 122. Syntype workers, SOUTH AFRICA: Cape Prov., Ladismith (*H. Brauns*) (MHN, Geneva). [Synonymy by Brown, 1964.]

Rhoptromyrmex transversinodis var. *pretoriae* Arnold, 1926 : 282. Syntype workers, female, male, SOUTH AFRICA: Pretoria, 21.iv.1915 (*C. K. Brain*) (BMNH) [examined]. [Synonymy by Brown, 1964.]

Distribution. Rhodesia, South Africa.

***Rhoptromyrmex critchleyi* sp. n.**

(Text-figs 3, 12)

Holotype worker. TL 2·7, HL 0·66, HW 0·64, CI 97, SL 0·42, SI 66, PW 0·42, AL 0·74. With the following combination of characters within the genus:

1, antennae with eleven segments;
2, propodeum armed with a pair of spines;
3, head, alitrunk and pedicel densely reticulate-punctate;
4, postpetiole in dorsal view subglobular, somewhat broader than long.

Paratypes: two workers. As holotype but measuring: TL 2·4–2·6, HL 0·60–0·64, HW 0·58–0·64, CI 97–100, SL 0·38–0·40, SI 63–65, PW 0·36–0·42, AL 0·66–0·72 (2 measured).

Holotype worker, NIGERIA: Ibadan, I.I.T.A. no. 34 G, 23–27.xi.1973 (*B. R. Critchley*) (BMNH).

Paratypes. 2 workers, as holotype but collected on 11–16.x.1973 (BMNH; MCZ, Cambridge).

Within the genus this species is very easy to distinguish as it is the only known species of the Ethiopian region in which propodeal spines are present in the worker caste, and it is the only member of the genus as a whole in which the antennae have eleven segments (as opposed to twelve in all other species).

Apart from its reduced antennomere count, *critchleyi* is a quite ordinary member of genus *Rhoptromyrmex* and tends to substantiate the synonymy of *Acidomyrmex* within this genus (see discussion above). It also shows again that the use of antennal segment number to diagnose the genera of Tetramoriini is unsatisfactory.

As in other genera the number of antennal segments varies in *Rhoptromyrmex* whilst other characters of diagnostic value at generic level remain constant. This is also seen to be true in *Tetramorium* and *Triglyphothrix*, where counts of 11 or 12, and 10, 11 or 12 respectively, have been recorded.

STRONGYLOGNATHUS Mayr

(Text-figs 13–18)

Strongylognathus Mayr, 1853 : 389. Type-species: *Eciton testaceum* Schenck, 1852 : 117 [= *Myrmus emarginatus* Schenck, 1853]; by monotypy.

Myrmus Schenck, 1853 : 188. Type-species: *Myrmus emarginatus* Schenck, loc. cit.; by monotypy. [Junior homonym of *Myrmus* Hahn, 1832 : 81.]

Diagnosis. *Worker*. Mandibles falcate, edentate or with a minute denticle which may occur near the apex in some individuals. Mandibular blades elongate, tapering, and curved from base to apex so that when their tips cross a space is enclosed between their inner margins and the anterior clypeal margin (Text-figs 13, 14). Palp formula 4,3 (dissections of *testaceus*, *afer*, *huberi*, *destefanii*). Median longitudinal carina of clypeus and head capsule absent. Antennal scrobes absent. Antennae 12-segmented, the three apical antennomeres forming a club. Metanotal groove feebly impressed; propodeum usually with a pair of very small teeth or denticles (Text-figs 17, 18), in some these are so reduced that the propodeum is virtually unarmed. Apicodorsal lamelliform appendage of sting triangular or pennant-shaped.

Female. As worker but with alitrunk possessing a full complement of flight sclerites, the queens winged when virgin. Ocelli present.

Male. Mandibles falcate and edentate as in worker and female, but relatively much smaller. Antennae 10-segmented, the second funicular forming an elongate fusion-segment as is usual in the tribe (Text-fig. 15).

Amongst the Tetramoriini *Strongylognathus* is easily distinguished by its remarkable falcate mandibles. The genus is restricted, as far as is known, to the Palaearctic region, ranging from North Africa to northern U.S.S.R., and from the British Isles to Korea and Japan. All species of the genus live in a dulotic, a rather degenerate obligate dulotic association, or as inquilines, in nests of *Tetramorium caespitum* (L.) and its close relatives. Information on the biology of the species may be found in Wheeler (1910), Stumper (1950), Kutter (1923; 1969), Wilson (1971), and the references included in these publications.

The taxonomy of the *huberi*-group species of western Europe has recently been worked out by Baroni Urbani (1969), and some species of eastern Europe and U.S.S.R. have been reviewed by Pisarski (1965), but a formal revision of the genus in its entirety has not yet been undertaken.

Roughly, the genus falls into two species-groups. The first of these includes only *testaceus* (Text-figs 13, 17) and *karawajewi*, in which the occipital angles are strongly produced, whilst the second includes all the remaining forms described to the present in which the occipital angles are not produced (Text-fig. 14). In the list and summary given below, no infraspecific taxa are recognized as throughout the other genera of this tribe they have proved illusory and in all cases have turned out to be either good species or synonyms of some other named form. In the light of these findings the infraspecific names remaining in *Strongylognathus*, after the partial revisions of Pisarski (1965) and Urbani (1969) have been taken into account, are here all raised provisionally to the rank of species until a formal revision of the entire genus can be undertaken. This action applies to the names *foreli*, *ruzskyi*, *bulgaricus* and *italicus*, but is not to be taken as the last word on the subject. In fact, the variation shown between series constituting what are presently termed species in the *huberi*-group are in many cases extremely trivial and no greater than that found between different populations or nests of what are unquestionably the same species elsewhere in the tribe. I think that many of the species-level names in the genus may merely be localized populations and I am convinced that further collections and study will reduce the number of species in *Strongylognathus* to a much lower figure.

SYNONYMIC LIST OF SPECIES

- ***testaceus***-group
  - ***karawajewi*** Pisarski
  - ***testaceus*** (Schenck)
    - *emarginatus* (Schenck)
    - *diveri* Donisthorpe
- ***huberi***-group
  - ***afer*** Emery
  - ***alboini*** Finzi
  - ***alpinus*** Wheeler
  - ***bulgaricus*** Viehmeyer **stat. n.**
    - *kratochvili* Šilhavy
  - ***caeciliae*** Forel
  - ***cecconii*** Emery
  - ***christophi*** Emery
  - ***dalmaticus*** Baroni Urbani
  - ***destefanii*** Emery
    - *huberi* st. *cecconii* var. *kutteri* Santschi
  - ***emeryi*** Menozzi
  - ***foreli*** Emery **stat. n.**
  - ***huberi*** Forel
    - *huberi* var. *gallica* Emery
  - ***insularis*** Baroni Urbani
  - ***italicus*** Finzi **stat. n.**
  - ***kervillei*** Santschi
  - ***koreanus*** Pisarski
  - ***palaestinensis*** Menozzi
  - ***rehbinderi*** Forel
  - ***ruzskyi*** Emery **stat. n.**
  - ***silvestrii*** Menozzi

SUMMARY OF THE SPECIES

THE *TESTACEUS*-GROUP

Strongylognathus karawajewi Pisarski

Strongylognathus karawajewi Pisarski, 1965 : 521, figs 40–43. Holotype and paratype workers, U.S.S.R.: Crimea, Magaratsch 26.iii.1903 (*Rjasantev*) (MNHU, Berlin; Institute of Zoology, Kiev; Institute of Zoology, Warsaw).

Distribution. U.S.S.R.: Crimea.

Strongylognathus testaceus (Schenck)

(Text-figs 13, 15, 16, 17)

Eciton testaceum Schenck, 1852 : 117. Syntype worker, female, male, GERMANY (WEST): Nassau distr., NW. of Frankfurt (coll. *Schenck*?) (location of types not known, perhaps in MNHU, Berlin).
Strongylognathus testaceus (Schenck); Mayr, 1853 : 389.
Myrmus emarginatus Schenck, 1853 : 188. Syntype workers, GERMANY (WEST): Nassau distr., NW. of Frankfurt (*Schenck*) (location of types not known, perhaps in MNHU, Berlin). [Synonymy by Mayr, 1853.]
Strongylognathus diveri Donisthorpe, 1936 : 113, figs 1, 2, 7. Holotype and paratype workers, ENGLAND: Dorset, Studland, Curlew Dyke, 5.v.1935 (*C. Diver*) (BMNH). [Synonymy by Brown, 1955.]

Distribution. Europe from Britain to the Caucasus and Ukraine, and from northern Europe to Italy.

THE *HUBERI*-GROUP

Strongylognathus afer Emery

Strongylognathus afer Emery, 1884 : 380, footnote. Holotype female, ALGERIA: Daya (*Bedel*) (probably in MCSN, Genoa).

Distribution. Algeria, Tunisia.

Strongylognathus alboini Finzi

Strongylognathus huberi subsp. *alboini* Finzi, 1924*b* : 121. Syntype workers, ITALY: Venezia Giulia, Monte Nanos, 28.v.1923 (*Finzi*) (MCZ, Cambridge).
Strongylognathus alboini Finzi; Urbani, 1969 : 141. [Raised to species.]

Distribution. Italy, Switzerland.

Strongylognathus alpinus Wheeler

Strongylognathus huberi subsp. *alpinus* Wheeler, 1909 : 178, figs 1c, d. Syntype workers, females, males, SWITZERLAND: Zermatt, Matter Valley, 1,620 m, 13.viii.1909; same loc. 14.viii.1909; Zermatt, bank of Triftbach R., 18.viii.1909 (*W. M. Wheeler*) (MCZ, Cambridge).
Strongylognathus alpinus Wheeler; Urbani, 1969 : 140. [Raised to species.]

Distribution. Switzerland.

Strongylognathus bulgaricus Viehmeyer **stat. n.** (provisional)

Strongylognathus huberi subsp. *rehbinderi* var. *bulgarica* Viehmeyer, 1922 : 211. Syntype workers, female, male, BULGARIA: Tirnowa (*F. Schimmer*) (probably in MNHU, Berlin).

Strongylognathus rehbinderi subsp. *bulgaricus* Viehmeyer; Pisarski, 1965 : 515. [Raised to subspecies.]

Strongylognathus kratochvili Šilhavy, 1937 : 5, figs 1–6. Syntype workers, female, CZECHOSLOVAKIA: W. Moravia, near Mohelno, 21.iii.1936 (*V. Šilhavy*) (location of types not known). [Synonymy by Pisarski, 1965.]

Distribution. Bulgaria, Czechoslovakia.

Strongylognathus caeciliae Forel

Strongylognathus caeciliae Forel, 1897 : 132. Holotype female, SPAIN: central Spain, Pozuelo (*M. Cabrera y Diaz*) (probably in MHN, Geneva). [See also Urbani, 1969.]

Distribution. Spain.

Strongylognathus cecconii Emery

Strongylognathus huberi subsp. *rehbinderi* var. *cecconii* Emery, 1908 : 24. Syntype workers, ITALY: Isole Tremiti, S. Nicola, Caprara (MCZ, Cambridge; probably also in MCSN, Genoa).

Strongylognathus cecconii Emery; Urbani, 1969 ; 153. [Raised to species.]

Distribution. Italy.

Strongylognathus christophi Emery

Strongylognathus christophi Emery, 1889*a* : 439. Lectotype female, U.S.S.R.: Volga, Sarepta (MCSN, Genoa), by designation of Pisarski, 1965.

Distribution. U.S.S.R.: N. shores of Caspian Sea northwards to Urals and vicinity of Kazan.

Strongylognathus dalmaticus Urbani

Strongylognathus dalmaticus Urbani, 1969 : 154, figs 2F, 3F, 4F. Holotype and paratype workers, YUGOSLAVIA: Isola Busi (Archipelago Dalmata), 24.vii.1968 (*C. Baroni Urbani*) (NM, Basle; MCSN, Verona).

Distribution. Yugoslavia.

Strongylognathus destefanii Emery

(Text-figs 14, 18)

Strongylognathus destefanii Emery, 1915*c* : 263. Holotype female, SICILY: Dintorni di Palermo (*De Stefani*) (probably in MCSN, Genoa).

Strongylognathus huberi st. *cecconii* var. *kutteri* Santschi, 1927 : 58. Holotype female, SICILY: Segesta (*H. Kutter*) (probably in NM, Basle). [Synonymy by Urbani, 1969.]

Distribution. Sicily.

Strongylognathus emeryi Menozzi

Stronglognathus emeryi Menozzi, 1921 : 30, fig. 3. Holotype female, ITALY: Calabria, Sambiase (probably in IE, Bologna).

Distribution. Italy; Calabria.

Strongylognathus foreli Emery **stat. n.** (provisional)

Strongylognathus huberi var. *foreli* Emery, 1909 : 709, fig. 4. Holotype (?) worker, ALGERIA (probably in MCSN, Genoa). [See also Urbani, 1969 : 138; *foreli* may be worker of *afer*.]

Distribution. E. Algeria.

Strongylognathus huberi Forel

Strongylognathus huberi Forel, 1874 : 71. Syntype workers, SWITZERLAND: Fully (MHN, Geneva; BMNH; MCZ, Cambridge).

Strongylognathus huberi var. *gallica* Emery, 1909 : 709. Syntype workers, FRANCE: Marseilles (probably in MCSN, Genoa). [Synonymy by Urbani, 1962.]

Distribution. S. France, Switzerland, N. Italy.

Strongylognathus insularis Urbani

Strongylognathus insularis Urbani, 1968 : 470, figs 38, 39. Holotype and paratype workers, MALTA: Comino I., 24.iv.1965 (*C. Baroni Urbani*) (NM, Basle; MCZ, Cambridge; MCSN, Verona).

Distribution. Malta.

Strongylognathus italicus Finzi **stat. n.** (provisional)

Strongylognathus huberi subsp. *italica* Finzi, 1924*a* : 14. Holotype female, ITALY: Isle of Elba, iv. 1921 (*Finzi*) (MCZ, Cambridge).

Distribution. Isle of Elba.

Strongylognathus kervillei Santschi

Strongylognathus kervillei Santschi, 1921 : 113. Syntype workers, TURKEY: Angora prov. (*H. G. de Kerville*) (probably in NM, Basle).

Distribution. Turkey: Angora prov.

Strongylognathus koreanus Pisarski

Strongylognathus koreanus Pisarski, 1965 : 519, figs 36–39. Holotype and paratype workers, KOREA: Myohyang Mts, 9.viii.1959 (*B. Pisarski & J. Proszynski*) (Institute of Zoology, Warsaw; MCZ, Cambridge).

Distribution. Korea.

Strongylognathus palaestinensis Menozzi

Strongylognathus palaestinensis Menozzi, 1933 : 75, fig. 5. Holotype female, 'PALESTINE': Gebata (*Bodenheimer*) (probably in IE, Bologna).

Distribution. Palestine.

Strongylognathus rehbinderi Forel

Strongylognathus christophi var. *rehbinderi* Forel, 1904 : 2. Syntype workers, U.S.S.R.: Caucasus, Neu Athos (= Novyj Afon) (*Rehbinder*) (MHN, Geneva; MNHU, Berlin).
Strongylognathus rehbinderi Forel; Pisarski, 1965 : 512. [Raised to species.]

Distribution. Caucasus, E. shores of Black Sea.

Strongylognathus ruzskyi Emery **stat. n.** (provisional)

Strongylognathus huberi subsp. *ruzskyi* Emery, 1909 : 711, fig. 6. Holotype worker, U.S.S.R.: Ural, Inderskaia-Gebirge (probably in MCSN, Genoa).

Distribution. Urals.

Strongylognathus silvestrii Menozzi

Strongylognathus silvestrii Menozzi, 1936 : 292, fig. 14. Syntype workers, female, GREECE: Isole Rodi (= Rhodes), Mt Attairo, 800 m (= Mt Attaviros); Cattavia (probably in IE, Bologna).

Distribution. Rhodes I.

TELEUTOMYRMEX Kutter

(Text-figs 24–26)

Teleutomyrmex Kutter, 1950 : 82. Type-species: *Teleutomyrmex schneideri* Kutter, loc. cit.; by original designation.

DIAGNOSIS. *Female.* Mandibles blade-like, edentate except for the acute apical tooth. Palp formula 1,1; the maxillary palp with a second prominence standing beside it, resembling a second one-segmented palp. Antennae 10- or 11-segmented, the second to fourth funicular segments showing a variable degree of fusion. In specimens where antenna is distinctly 10-segmented then the second funicular is an elongate fusion-segment. Clypeus shallowly transversely concave. Ocelli present. Alitrunk with flight sclerites, winged in virgins; the alitrunk compressed from side to side; metapleural glands absent. Petiole sessile, postpetiole very broadly attached to first gastral segment. Gaster very strongly dorsoventrally flattened, the ventral surface concave; mature females physogastric. Sting very reduced, non-functional.

Male. Mandibles as female but much smaller. Palp formula 1,1. Antennae 10-segmented, the second funicular antennomere an elongate fusion-segment. Ocelli present; wings present but the remainder of the body appearing pupoidal. Gaster downcurved, somewhat reflexed anteriorly.

This genus contains a single species, *T. schneideri*, a degenerate workerless, permanent social parasite in nests of *Tetramorium caespitum*. The females of *schneideri* are to be found riding upon the queen of the host colony, which is not killed. The males, as in *Anergates*, are pupoidal but unlike that genus the males of *schneideri* possess wings. As yet the species has not been recorded outside the nests of its host-species.

Apart from the original description, which contains a good deal of information, studies dealing with the biology, behaviour and anatomy of *T. schneideri* include those of Stumper (1950), Gösswald (1952), Kutter (1969), and a summary in Wilson (1971).

Teleutomyrmex schneideri Kutter

Teleutomyrmex schneideri Kutter, 1950 : 82, figs 1–23. Syntype females, males, SWITZERLAND: Saas-Fee, 25.vii.1949 (*H. Kutter*) (in coll. Kutter; BMNH).

The species is known only from the type-locality and from a second collection made near Briançon in the French Alps (Collingwood, 1956).

TRIGLYPHOTHRIX Forel

(Text-figs 32–73)

Triglyphothrix Forel, 1890 : cvi. Type-species: *Triglyphothrix walshi* Forel, op. cit.: cvii; by monotypy.

DIAGNOSIS. *Worker*. Mandibles with three teeth apically, the third smaller than the second, and followed by a row of three or four small or minute denticles; the arrangement 3 teeth + 4 denticles predominating (Text-fig. 36). Palp formula 4,3 (dissections of *lanuginosa*, *walshi*, *fulviceps*, *meshena*, *kheperra*, *brevispinosa*, *arnoldi*, *constanciae*, *eminii*, *gabonensis*, *rothschildi*, *inezulae*), often reduced to a 3,3 formula in minute species (dissections of *cryptica*, *muscorum*, *gestroi*, *furtiva*). Antennae with 10, 11 or 12 segments, the apical three forming a distinct club. The 12-segment count predominates, only three species are known with 11 and only one species (*decamera*) has 10 antennal segments, but this is known only in the female caste at present. Eyes present, at or in front of the middle of the sides of the head, usually large, rarely reduced. Frontal carinae very broad, the maximum span of the lobes often being more than twice the distance from the edge of the lobe to the side of the head in a straight line. Clypeus convex or angled in profile, with a median longitudinal carina extending its length (weak in some species). Median carina present along length of cephalic dorsum, a continuation of the median clypeal carina and usually very distinct, only in some heavily sculptured species is its track vague. Antennal scrobes usually present, broad and divided into upper and lower compartments by a longitudinal carina or ridge. In a few species the scrobes are reduced but very rarely are they completely absent (Text-figs 42, 44, 45). Alitrunk fusiform, without sutures; metanotal groove absent, the outline of the alitrunk unbroken in profile (Text-figs 52–72). Propodeum usually armed with a pair of spines or teeth, unarmed only in a very few species. Metapleural lobes present, often acute or dentiform. Petiole pedunculate, without a large ventral process. In species of the Ethiopian region there is a marked tendency for the petiole and postpetiole to be expanded laterally, transverse in dorsal view. Apicodorsal appendage of sting triangular, dentiform or pennant-shaped. A simple tibial spur is generally present on the middle and hind legs in large species, absent in smaller forms. Sculpture is usually coarse on head and alitrunk, the predominant sculpture being a dense rugoreticulum, but this differs in some species. Pilosity dense, at least some part of the head or body bearing regularly branched (bifid, trifid or quadrifid) hairs, either with or without simple hairs also being present (Text-figs 32–35). Branched hairs are absent in only one species, which is suspected of a cleptobiotic lifeway.

Female. Generally as worker but virgin females fully alate, with flight sclerites and ocelli.

Male. Known for only a few species. With the general tetramoriine characters and also with branched hairs as in the workers and females. Antennae 10-segmented, the second funicular forming an elongate fusion-segment (Text-fig. 40). Palp formula 4,3 in the two species dissected (*constanciae*, *inezulae*), as worker. Whether the smaller species show the reduced palp formula of 3,3 in males as well as workers remains to be seen.

Triglyphothrix is a moderately sized genus containing some 55 presently recognized species, of which 33 occur in the Ethiopian region and the remaining 22 are distributed throughout the rest of the Old World tropics and subtropics, with the exception of Australia and Madagascar where only *lanuginosa* is present. This species is well known throughout the world as a very successful tramp species, and on occasion it is reported from hothouses or constantly heated buildings in temperate zones, as well as from localities in the tropics which are outside the range of the genus as a whole.

As far as is known, most species are predominantly cryptic foragers of the forest floor, although some have extended their range into savannah or open grass or woodland. One species, *arnoldi*, is apparently cleptobiotic in nests of large ponerine ants, nesting in the walls of their galleries and tunnels, and *microps* has also been recorded from a similar locality (Arnold, 1917). Apart from these the remaining species nest either directly into the soil, when a small crater-entrance may be produced, or under stones and logs, or in twigs or rotten wood in the leaf-litter layer. In some species the nests are made in twigs anywhere in the litter, but in others a definite site at the base of a standing tree appears to be preferred. No species are known to be arboreal or subarboreal in habits.

Most, if not all, species forage singly and move slowly, the more densely hairy species presenting a furry appearance to the naked eye. They are general predators and scavengers, collecting fresh or dead arthropods, but are not known to tend homopterous insects nor to visit plant nectaries.

Previous studies of the genus have dealt only with a limited number of species, on a regional basis. These include the work of Arnold (1917; 1926) on the South African fauna, Emery (1893), Forel (1902*b*) and Bingham (1903) on the Indo-Malayan fauna, and Mann (1919) on the New Guinea and Solomon Islands species.

The main outstanding feature of the genus as a whole is the possession of numerous or abundant branched hairs. These may be bifid, trifid or quadrifid and in a few species a mixture of two or more of these may be present. In many species simple hairs are also present on the dorsal surfaces, generally far fewer in number than their branched counterparts and in some species seeming to serve a specialized function as they occur only upon the leading edges of the antennal scapes or the dorsal surfaces of the upper margins of the antennal scrobes in a spaced row. The majority of species, however, have simple hairs upon the mouthparts and around the gastral apex, although in a few these are absent. Only one species in the genus has lost its branched hairs (*arnoldi*) and I am sure that in this case it is a secondary development as branched hairs are present in the closest relatives.

Species of the Ethiopian Region

Synonymic list of species

- ***paupera***-group
  - ***antrema*** **sp. n.**
  - ***cryptica*** **sp. n.**
  - ***distincta*** **sp. n.**
  - ***menkaura*** **sp. n.**
  - ***minima*** **sp. n.**
  - ***muscorum*** (Arnold)
  - ***paupera*** Santschi
    - *ericae* (Arnold) **syn. n.**
- ***osiris***-group
  - ***osiris*** **sp. n.**
  - ***reptana*** **sp. n.**
  - ***yarthiella*** **sp. n.**
- ***inezulae***-group
  - ***arnoldi*** Forel
  - ***desertorum*** Forel
  - ***furtiva*** Arnold
  - ***gestroi*** Menozzi
  - ***imbellis*** Emery
  - ***inezulae*** Forel
    - *hepburni* (Arnold) **syn. n.**
    - *hepburni* subsp. *mashonana* Arnold **syn. n.**
  - ***microps*** Mayr
    - *auropunctatus* Forel **syn. n.**
    - *auropunctatus* var. *pallens* Forel **syn. n.**
    - *auropunctatus* var. *fusciventris* Forel **syn. n.**
    - *auropunctatus* var. *rhodesiana* Forel **syn. n.**
    - *auropunctatus* var. *bulawayensis* (Arnold) **syn. n.**
  - ***talpa*** **sp. n.**
  - ***tenebrosa*** (Arnold) **stat. n.**
  - ***trimeni*** Emery
- ***rothschildi***-group
  - ***rothschildi*** Forel
- ***gabonensis***-group
  - ***agna*** Santschi
  - ***baufra*** **sp. n.**
  - ***brevispinosa*** Stitz **stat. n.**
    - *nion* Bernard **syn. n.**
  - ***constanciae*** (Arnold)
    - *longispinosa* Arnold **syn. n.**
  - ***dedefra*** **sp. n.**
  - ***emenii*** Forel
    - *marthae* Forel **syn. n.**
    - *marleyi* Forel **syn. n.**
    - *marleyi* var. *akermani* (Arnold) **syn. n.**
    - *guillodi* Santschi **syn. n.**
    - *guillodi* var. *mus* Santschi **syn. n.**
    - *cinereus* Weber **syn. n.**
  - ***gabonensis*** André
    - *gabonensis* st. *soyauxi* Forel **syn. n.**

- *mucida* Forel **syn. n.**
- *areolata* Stitz **syn. n.**
- *gabonensis* var. *boulognei* Forel **syn. n.**
- *gabonensis* var. *kamerunensis* Santschi **syn. n.**
- *areolata* var. *burgeoni* Santschi **syn. n.**

monardi Santschi
pulcherrima Donisthorpe
sericea (Arnold) **stat. n.**
silvestrii Emery
thoth sp. n.

THE SPECIES-GROUPS

THE *paupera*-GROUP. This group contains seven very small to minute species, all of which possess elongate simple hairs which project in a row along the anterior edges of the scapes and along the upper borders of the frontal carinae which form the dorsal margins of the scrobes. Hairs on the first gastral tergite are predominantly a mixture of simple and bifid, sometimes with a few trifid, hairs present but never with dense trifid or quadrifid pilosity.

Three of the species of this group (*antrema*, *cryptica*, *muscorum*) have only 11 antennomeres and have the palp formula reduced to 3,3 from its normal 4,3 value. The other four species have the normal antennomere count of 12. Most of the species are of west and central African origin, more or less confined to the rain forest zones, but *muscorum* occurs virtually throughout Africa where there is wet or riverine forest, and *paupera* is known only from Rhodesia. All seven species are denizens of the leaf-litter layer in forests.

THE *osiris*-GROUP. The three species of this small group show relationship to the *paupera*-group in that they possess a row of elongate simple hairs both on the leading edges of the antennal scapes and on the upper surfaces of the frontal carinae. They are, however, considerably larger than *paupera* and its allies and have the first gastral tergite covered with a dense mat of branched hairs which are predominantly or universally quadrifid.

The members of the group are only known from their type-localities, but the group as a whole shows a wide distribution, with *osiris* from Ghana, *reptana* from Uganda and *yarthiella* from Zambia.

THE *inezulae*-GROUP. Ten species are known in this group; they are characterised by the lack of long simple hairs on the antennal scapes and their presence in a row on the upper margins of the frontal carinae. Also in this group there is a tendency for the node of the petiole to be strongly compressed antero-posteriorly so that it is transverse in dorsal view.

This group is predominantly of eastern and southern Africa, with only a few species extending their range into the central and west African forest zones. A number of complexes of closely related species can be discerned within the group. One complex, consisting of *arnoldi*, *imbellis* and *microps*, has the eyes very reduced, their maximum diameter being distinctly less than the maximum width of the scape (in all other African species the eyes are larger than the maximum scape width). This complex occurs mainly in southern Africa but *imbellis* is found in Ethiopia. The species *desertorum*, *inezulae*, *talpa* and *trimeni* possess sculpture on the basal portion of the first gastral tergite, and these species range from Zaire to South Africa. The two smallest species of the group, *furtiva* and *gestroi*, occur in forested areas in deep leaf-litter.

THE *rothschildi*-GROUP. Only a single species, *rothschildi*, is placed in this group and it is certainly the most aberrant member of the genus yet known from the Ethiopian region. The species is large, antennal scrobes are completely absent, and the anterior clypeal margin has a deep median emargination. *T. rothschildi* is widely but sporadically distributed in dry or semi-desert localities in Africa and appears to be the only African species in this genus to be adapted to such conditions.

THE *gabonensis*-GROUP. The largest species-group in the Ethiopian region, with 12 members, it also contains two of the most common species of the region. All members of this group are characterised by the lack of elongate simple hairs both on the scapes and on the upper surfaces of the frontal carinae. The body is usually stocky and abundantly covered with branched trifid or quadrifid hairs, giving the ant af urry appearance to the naked eye. Members of this group occur throughout the Ethiopian region, the preferred nesting sites of the species being in rotten wood or directly into the earth.

The species *agna* and *eminii* are closely related and have the antennal scrobes reduced and non-functional. Of the remainder *baufra*, *brevispinosa*, *constanciae* and *gabonensis* are quite large, active, relatively conspicuous species; the rest are smaller and tend to be more cryptic, inhabiting leaf-litter or, in the case of *pulcherrima*, sandy areas.

KEY TO SPECIES

(Workers)

Note. The worker of *desertorum* is not known but the queen is very close to that of *inezulae*. The worker, when found, would therefore be expected to key out at couplet 17.

1 Antennae with 11 segments 2
– Antennae with 12 segments 4
2 Dorsum of head and alitrunk finely but distinctly reticulate-regulose . . . 3
– Dorsum of head with a few fine, scattered longitudinal rugulae with shining interspaces, alitrunk with scattered fine longitudinal rugulae, not reticulate-rugulose (Cameroun) . . . . **antrema** (p. 318)
3 Clypeus with a raised transverse carina at the level of the extreme anterior portions of the frontal carinae, the transverse carina as strongly developed as the median longitudinal carina which it crosses. Head and alitrunk yellow or yellow-brown. (Ivory Coast, Ghana, Cameroun, Uganda, Zaire, Gabon, C. African Repub., Angola, S. Africa, Mozambique) . . . . **muscorum** (p. 331)
– Clypeus without a transverse carina crossing the median longitudinal carina. Head and alitrunk black or blackish brown. (Ghana) . . . **cryptica** (p. 321)
4 With the head in profile the antennal scrobe is either very short and shallow, without a sharp dorsal margin and not divided into upper and lower portions by a longitudinal carina, or is completely absent (Text-figs 42, 44, 45). The area

of the scrobe is generally as strongly sculptured as the remainder of the head and always has hairs arising within the scrobal area 5

– With the head in profile the antennal scrobe developed, long and deep, reaching well beyond the posterior margin of the eye and with a sharp dorsal margin. Scrobe less strongly sculptured than the remainder of the head (except when head itself is unsculptured); without hairs arising within the scrobal area and generally divided into upper and lower portions by a median carina, at least anteriorly (Text-figs 43, 46–51) 7

5 Propodeum unarmed, without spines or teeth. (Zaire) . . . . ***agna*** (p. 317)

– Propodeum armed with a pair of spines or teeth 6

6 Anterior border of clypeus broadly and deeply emarginate medially (Text-fig. 42). Basal portion of first gastral tergite finely, closely and densely longitudinally striate. Very large species, $\mathrm{HW} > 0{\cdot}95$, $\mathrm{SL} > 0{\cdot}60$. (Arid zones of Ghana, Ethiopia, Kenya) . . . . ***rothschildi*** (p. 334)

– Anterior border of clypeus transverse, not emarginate medially (Text-fig. 44). Basal portion of first gastral tergite unsculptured or with a few pits from which hairs arise, not densely striate. Smaller species, $\mathrm{HW} < 0{\cdot}85$, $\mathrm{SL} < 0{\cdot}60$. (Ethiopia, Sudan, Nigeria, Kenya, Tanzania, Angola, S. Africa) . ***eminii*** (p. 324)

7 Head, alitrunk, pedicel and gaster without branched hairs, all hairs simple and short. Dorsum of alitrunk finely and very densely reticulate-punctate, matt. [Presumed cleptobiont in nests of large ponerine ants.] (Rhodesia) . ***arnoldi*** (p. 318)

– At least part of head or body with branched hairs, bifid, trifid or quadrifid; additional simple hairs may be absent or present. Dorsum of alitrunk not densely reticulate-punctate 8

8 Dorsal margins of frontal carinae which form the upper borders of the antennal scrobes behind the antennal insertions with a spaced row of elongate simple hairs which are distinctly longer than the surrounding (usually branched) hairs (Text-fig. 37). These long hairs are often erect but in some species are directed laterally; rarely similar long hairs may be present elsewhere on the dorsum of the head also 9

– Dorsal margins of frontal carinae which form the upper borders of the antennal scrobes behind the antennal insertions either without a spaced row of elongate simple hairs or very rarely with a few simple hairs which are very short and do not project above the level of the surrounding branched hairs, not easily seen . 23

9 Propodeum without spines or teeth, with a pair of minute blunt tubercles which are much shorter than the metapleural lobes (Text-fig. 55) 10

– Propodeum armed with a pair of spines or acute teeth which are usually longer than the metapleural lobes 11

10 Dorsal surfaces of head and alitrunk unsculptured apart from the median carina on the head and a few scattered punctures. (Ghana) . . . ***menkaura*** (p. 328)

– Dorsal surfaces of head and alitrunk distinctly rugulose. (Ethiopia) . ***imbellis*** (p. 327)

11 Hairs on anterior (leading) edge of antennal scape of varying length, the longest being simple and at least as long as the maximum width of the scape. If the longest hairs are subequal to the maximum scape width then elongate simple hairs are present on the dorso-lateral pronotal margins which are distinctly longer and more conspicuous than the neighbouring branched hairs 12

– Hairs on anterior (leading) edge of antennal scape of uniform length and generally branched, all distinctly much shorter than the maximum width of the scape, often less than half the maximum scape width and sometimes closely applied to the surface 17

12 Strongly bicoloured species: head, gaster and usually also pedicel black; alitrunk, legs, antennae and mandibles clear yellow. (Ghana) . . . ***distincta*** (p. 323)

– Either uniformly coloured species or with the gaster somewhat darker than the head and alitrunk, but not bicoloured black and yellow as above 13

13 Clypeus with a raised transverse carina at the level of the extreme anterior portions of the frontal carinae, the transverse carina as strongly developed as the median longitudinal clypeal carina which it crosses. (Ivory Coast, Ghana, Nigeria) ***minima*** (p. 330)

– Clypeus without a transverse carina crossing the median longitudinal carina . . 14

14 First gastral tergite basally with a broad belt of coarse punctate sculpture which extends approximately over the basal one-third of the sclerite. (Zambia) ***yarthiella*** (p. 338)

– First gastral tergite basally without a belt of punctate sculpture, smooth and shining 15

15 Longest hairs on dorsum of head behind clypeus (discounting those on upper scrobe margins) distinctly shorter than the maximum vertical width of the eye with the head in profile. Small species, $HW < 0{\cdot}50$, $SL < 0{\cdot}35$. (Rhodesia) ***paupera*** (p. 333)

– Longest hairs on dorsum of head behind clypeus (discounting those on upper scrobe margins) distinctly longer than the maximum vertical width of the eye with the head in profile. Larger species, $HW > 0{\cdot}50$, $SL > 0{\cdot}35$ 16

16 Apical halves of mandibles longitudinally striate. First gastral tergite with a mixture of simple and bifid hairs, quadrifid hairs absent. Propodeal spines in profile not downcurved along their length. (Cosmopolitan tramp species) ***lanuginosa*** (p. 350)

– Apical halves of mandibles smooth and shining, with scattered small pits. First gastral tergite with hairs predominantly quadrifid. Propodeal spines in profile narrow and slightly downcurved along their length (Text-fig. 61). (Ghana) ***osiris*** (p. 332)

17 Eyes very small, their maximum diameter distinctly less than the maximum width of the antennal scape (Text-fig. 43). (Angola, Rhodesia, S. Africa) . ***microps*** (p. 329)

– Eyes larger, their maximum diameter at least equal to the maximum width of the antennal scape, usually distinctly greater 18

18 Base of first gastral tergite immediately behind the postpetiole with a transverse band of dense and quite coarse punctate sculpture; this area distinctly more coarsely sculptured than the remainder of the tergite 19

– Base of first gastral tergite without a band of dense punctate sculpture immediately behind the postpetiole. Usually this area as smooth as the remainder of the tergite but if some faint shagreening is present then the species is large, with $SL > 0{\cdot}50$ 21

19 Hairs on first gastral tergite almost entirely simple, with only one or two bifid or trifid hairs present. Colour uniform pale yellow-brown. (Zaire) . ***talpa*** (p. 336)

– Hairs on first gastral tergite universally branched, bifid, trifid, without simple hairs present. Colour uniform medium to dark brown 20

20 Lower portion of antennal scrobe sculptured above the eye. The longitudinal carina which divides the scrobe into upper and lower portions indistinct, appearing only as a boundary to or continuation of the sculptured area beneath it. Smaller species, SL 0·34 or less. (S. Africa) . . . . . ***trimeni*** (p. 338)

– Lower portion of antennal scrobe not or only very faintly sculptured above the eye, the longitudinal carina dividing the scrobe into upper and lower portions sharp and distinct. Larger species, SL 0·38 or more. (Zaire, Tanzania, Rhodesia, S. Africa) . . . . ***inezulae*** (p. 327)

21 Large species, HW 0·80 or more, SL 0·50 or more, PW 0·60 or more. (Kenya, Mozambique) . . . . ***tenebrosa*** (p. 337)

– Small species, $HW < 0{\cdot}65$, $SL < 0{\cdot}45$, $PW < 0{\cdot}50$ 22

22 Full adult colour black or blackish brown. Sculpture of dorsal alitrunk predominantly of quite coarse longitudinal rugulae which may be wavy or meandering. (Ghana, Cameroun, Gabon, Angola, Rhodesia) . . . . ***furtiva*** (p. 325)

– Full adult colour yellow or light yellow-brown. Sculpture of dorsal alitrunk a reticulum of fine rugulae, not predominantly longitudinal in direction (Uganda, Angola, Gabon) . . . . ***gestroi*** (p. 326)

23 Propodeum without spines or teeth, in profile with only a pair of low, minute, obtuse tubercles (Text-fig. 56). (Uganda, Angola) . . . . . . ***dedefra*** (p. 322)

– Propodeum armed with a pair of spines or acute teeth 24

24 Head bright golden-yellow; alitrunk, pedicel and gaster blackish brown. Basal one-third to one-half of first gastral tergite with relatively coarse, regular longitudinal striation. (Uganda, Zaire) . . . . . . ***pulcherrima*** (p. 333)

– Unicolourous or the head, gaster or both darker in colour than the alitrunk, never as above. Basal one-third to one-half of first gastral tergite not regularly striate although in some species there is a band of punctate sculpture basally . . 25

25 Anterior (leading) edge of antennal scape with a row of very long simple hairs, the longest of which are distinctly much longer than the maximum width of the antennal scape. (Uganda) . . . . ***reptana*** (p. 334)

– Anterior (leading) edge of antennal scape with short, curved, usually branched hairs which are distinctly shorter than the maximum width of the scape . . . 26

26 Branched hairs on dorsal surfaces of head, alitrunk, pedicel and gaster strongly appressed, lying flat or nearly so against the surface of the sclerite from which they arise. (Rhodesia) . . . . ***sericea*** (p. 335)

– Branched hairs on dorsal surfaces of head, alitrunk, pedicel and gaster erect or suberect on some or all of these surfaces 27

27 Petiole node thickly crescentic in dorsal view. (Angola) . . ***monardi*** (p. 331)

– Petiole node transverse, not crescentic in dorsal view 28

28 Branched hairs on disc of first gastral tergite predominantly or universally trifid (Text-fig. 34) 29

– Branched hairs on disc of first gastral tergite predominantly or universally quadrifid (Text-fig. 35) 32

29 Lower portion of antennal scrobe below the median carina densely reticulate or rugulose throughout its length. (Rhodesia) . . . . . . ***baufra*** (p. 319)

– Lower portion of antennal scrobe below the median carina mostly smooth and shining, not reticulate or rugulose throughout its length 30

30 Mandibles smooth and shining with scattered small pits, not striate. Minute species, HW ca 0·54 at maximum. (S. Africa) . . . . . ***thoth*** (p. 337)

– Mandibles strongly longitudinally striate. Larger species, HW ca 0·68 at minimum 31

31 Petiole node in dorsal view with its anterior face convex. Larger species, HW ca 0·74 at minimum. Basal portion of first gastral tergite usually with punctures, generally sparse but sometimes coarse. (Guinea, Ivory Coast, Ghana, Togo, Nigeria, Cameroun, Uganda, Kenya, Sudan, C. African Repub., Gabon, Zaire) ***brevispinosa*** (p. 320)

– Petiole node in dorsal view with its anterior face flat and transverse. Smaller species, HW ca 0·68. Basal portion of first gastral tergite unsculptured. (Ethiopia.) . . . . ***silvestrii*** (p. 336)

32 Median clypeal carina weak or petering out anteriorly. Postpetiole smooth or with only faint traces of sculpture. Larger species, HW 0·90 at minimum, SL 0·68 at minimum. (Sudan, Uganda, Cameroun, Gabon, Zaire) . ***gabonensis*** (p. 325)

– Median clypeal carina strongly developed. Postpetiole strongly sculptured. Smaller species, HW 0·84 at maximum, SL 0·54 at maximum. (Rhodesia, Tanzania) . . . . ***constanciae*** (p. 321)

TREATMENT BY SPECIES

Triglyphothrix agna Santschi

Triglyphothrix agna Santschi, 1935 : 264, figs 7–9. Syntype workers, ZAIRE: Bikoro, 28.ii.1921 (*H. Schouteden*); Eala, 12.i.1921 (*H. Schouteden*) (NM, Basle) [examined].

Worker. TL 3·5, HL 0·80, HW 0·76, CI 95, SL 0·60, SI 79, PW 0·58, AL 0·92.

Antennal scrobes absent, the area occupied by the scrobe in other species narrow in *agna*, strongly sculptured, and with numerous hairs arising from it. In full-face view the frontal carinae strongly marked only to the level of the eye, behind this becoming indistinguishable from the other sculpture. Anterior pronotal corners in dorsal view broadly rounded. Propodeal spines completely absent, the metapleural lobes reduced to low, rounded structures. Petiole and postpetiole transverse in dorsal view, broader than long. Dorsal surfaces of head, alitrunk and petiole finely and quite densely reticulate-rugose, the postpetiole retaining traces of this sculpture but mostly smooth. Gaster unsculptured. Entirely covered with a thick coat of fine, branched hairs. Elongate simple hairs completely absent from appendages and dorsum of head and body. Hairs on first gastral tergite almost universally trifid, with a few quadrifid hairs in the apical half. Colour brown.

Very distinct through its lack of both propodeal spines and antennal scrobes, *agna* is apparently known only from the type-collection. Two other species in the Ethiopian region lack scrobes, *rothschildi* and *eminii*, but in both these species propodeal armament is retained.

Triglyphothrix antrema sp. n.

Holotype worker. TL 1·8, HL 0·48, HW 0·42, CI 89, SL 0·28, SI 67, PW 0·34, AL 0·48.

Antennae with 11 segments. Antennal scrobes strongly developed, deep, with an acute dorsal margin and well defined posteriorly and ventrally behind the eye. Median carina of scrobe distinct, reaching almost to the posterior margin of the eye. Clypeus with a very weak transverse carina crossing the median longitudinal carina and with a very strongly developed pair of lateral carinae. Propodeal spines short and acute, slightly longer than the metapleural lobes. Sculpture everywhere sparse, much of the integument smooth. Mandibles smooth with scattered small pits. Dorsum of head with median carina and with only 3–4 short, fine longitudinal rugulae on each side of it, without reticulation, the wide spaces between the rugulae shining. Dorsal alitrunk with sparse, widely spaced fine longitudinal rugulae, the spaces between them showing a faint trace of superficial sculpture but mostly shining. Pedicel segments finely and closely reticulate-rugulose, the gaster smooth and shining. Branched hairs present on all dorsal surfaces of head and body, predominantly bifid but with some trifid and even a few quadrifid hairs present, these last are best developed on the sides of the pedicel segments. Hairs on first gastral tergite predominantly simple but with a few bifid present. Dorsum of head with a row of elongate simple hairs spaced out along the upper margins of the antennal scrobes, and the antennal scapes with elongate simple hairs on the leading edge; the longest of these hairs are as long as the maximum width of the scape at least. Colour black, the antennae and femora dark brown, the tibiae of the legs yellowish white, contrasting strongly with the femora.

Holotype worker, CAMEROUN: WY [forest reserve of Ototomo, ca 40 km S. of Yaoundé] (*G. Terron*) (BMNH).

As can be seen from the description this minute species shares many characters with *muscorum* and *cryptica*, but the strongly reduced sculpture immediately isolates *antrema*.

Triglyphothrix arnoldi Forel

Triglyphothrix arnoldi Forel, 1913*b* : 220. Syntype workers, RHODESIA: Shiloh, 10.v.1913 (*G. Arnold*) (MHN, Geneva; BMNH) [examined].

Worker. TL 2·4–2·9, HL 0·58–0·68, HW 0·54–0·64, CI 90–97, SL 0·32–0·40, SI 59–65, PW 0·42–0·50, AL 0·66–0·76 (12 measured).

Antennal scobes strongly developed, with an acute, flange-like upper margin and a well-marked median longitudinal carina. Eyes reduced, very small, their maximum diameter distinctly less than the maximum width of the scape. Propodeal spines short but acute, at least as long as the metapleural lobes. Dorsum of head with a few reduced, longitudinal rugulae, the spaces between which are reticulate-punctate. Mandibles striate, the antennal scrobes reticulate-punctate. Dorsal surfaces of alitrunk and pedicel very finely and very densely reticulate-punctate, occasionally also with a few very faint rugulae which are almost completely effaced. Gaster usually completely smooth and shining but in a few individuals with a trace of sculpturation basally, very faint and weak. Branched hairs absent. Simple hairs numerous upon all dorsal surfaces, elongate on the dorsal surface of the upper scrobe margins. Colour yellow-brown, varying in shade, often with the gaster slightly darker than the head and alitrunk.

The only species in the Ethiopian region to lack branched hairs. This character, coupled with the reduced eyes and fine reticulate-punctate sculpturation on the alitrunk renders *arnoldi* very easily recognisable. Its closest relative is *microps*, but this species differs in its possession of numerous branched hairs and coarser, rugulose sculpture on the alitrunk. The similarities of the two species are striking, possibly through convergence due to lifeways, as both species have been recorded by Arnold (1917) as apparent plesiobionts or cleptobionts, building their nests in the walls of galleries constructed by the much larger ponerine species *Platythyrea lamellosa* (Roger) and *Ophthalmopone berthoudi* Forel in the case of *arnoldi*, and *Platythyrea cribrinodis* (Gerstaecker) in the case of *microps*. In distribution both species are apparently restricted to southern Africa.

MATERIAL EXAMINED.

RHODESIA: Bulawayo, Hillside (*G. Arnold*); Bulawayo, Waterworks (*G. Arnold*); Bulawayo (*G. Arnold*).

Triglyphothrix baufra sp. n.

(Text-figs 49, 57)

Holotype worker. TL 3·4, HL 0·80, HW 0·76, CI 95, SL 0·54, SI 71, PW 0·62, AL 0·92.

Upper portion of antennal scrobe strongly developed, deep; this upper section of the scrobe bordered below by a weakly developed median longitudinal carina. Below this carina the lower portion of the scrobe is virtually undeveloped and is sculptured throughout. Eyes large, their maximum diameter ca 0·22. (It is possible that the eyes are secondarily enlarged and have impinged upon the space formerly occupied by the lower portion of the scrobe.) Head in full face view with the sides distinctly convex, the eyes hemispherical and prominent. Propodeal spines short and acute. Mandibles smooth with scattered pits and a few small, longitudinally directed impressions, but not striate. Dorsum of head, alitrunk and petiole finely and densely reticulate-rugose, the postpetiole much more weakly sculptured, with superficial punctures or shagreening only. Gaster unsculptured. All dorsal surfaces with abundant branched hairs, those on the first gastral tergite universally trifid. Elongate simple hairs absent.

Paratype workers. As holotype, with dimensions TL 3·1–3·4, HL 0·78–0·82, HW 0·74–0·78, CI 94–96, SL 0·48–0·54, SI 65–71, PW 0·58–0·62, AL 0·88–0·94 (5 measured).

Holotype worker, RHODESIA: Somabula forest, 25.viii.1918 (*G. Arnold*) (BMNH),

Paratypes. 8 workers, same data as holotype (BMNH; MCZ, Cambridge; NM, Bulawayo).

These nine specimens were placed amongst the Arnold collection material in the BMNH and NM, Bulawayo close to *constanciae*, with a small label stating '*constanciae var.*'. These specimens are now recognised as a distinct species, closely related to *constanciae* but separable by the different form of the scrobe, the markedly convex sides of the head, larger eyes, shorter propodeal spines and trifid gastral hairs (quadrifid in *constanciae*).

Triglyphothrix brevispinosa Stitz **stat. n.**

(Text-figs 50, 58)

Triglyphothrix gabonensis var. *brevispinosus* Stitz, 1910 : 144. LECTOTYPE worker, TOGO: Bismarckburg (*Conradt*) (MNHU, Berlin), here designated [examined].

Triglyphothrix nion Bernard, 1952 : 248, fig. 14B. Syntype workers, GUINEA: Crête Nion, 1300 m, st. B6–26. 19/4 (*Lamotte*) (MNHN, Paris) [examined]. **Syn. n.**

Worker. TL 3·2–3·9, HL 0·74–0·90, HW 0·74–0·90, CI 98–103, SL 0·50–0·60, SI 65–73, PW 0·50–0·62, AL 0·80–0·94 (12 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and generally with the lower margin well defined behind the eye. Median longitudinal carina of scrobe distinct, in some populations the carina broken, branched or doubled above the eye. This condition is caused by the presence of a secondary carina arising below the median and running towards it posteriorly. The two meet or nearly meet above the eye and sometimes run parallel for a short distance. The development of this secondary carina varies amongst individuals of the same series, and in a number of workers is completely absent. Propodeal spines of moderate length, tapering apically and acute; metapleural lobes rounded. Head usually irregularly finely longitudinally rugulose, generally with faint reticulation posteriorly, more rarely strongly reticulate posteriorly and yet more rarely with the sculpture almost effaced so that the cephalic median carina forms the only distinct marking on the dorsum. Alitrunk and petiole usually finely reticulate-rugose, longitudinally rugose in some due to the suppression of transverse rugulae. Postpetiole usually less strongly sculptured than petiole. First gastral tergite generally with a band of punctate sculpture basally; this is often best developed in West African samples but may be reduced, faint or absent in different populations. Mandibles striate. Head, body and appendages densely coated with fine, branched hairs; elongate simple hairs absent from dorsal surfaces and appendages. Hairs on first gastral tergite universally trifid. Colour brown, of varying shades.

A widely distributed forest-inhabiting species, reasonably common in West Africa. I have found this species both in primary forest and more open woodland in Nigeria and Ghana and the nests in these localities have been made directly into the soil below any leaf-litter layer which may be present. The ants are slow-moving and have a distinctly furry appearance to the naked eye. Individual workers forage in the leaf-litter and on or in any rotten wood which is partially embedded in the litter layer. Specimens have been collected by Leston in Ghana by the pyrethrum knockdown technique, which implies that *brevispinosa* workers occasionally ascend trees, though I have never observed this behaviour myself.

The closest related species to *brevispinosa* is the dubiously separated *silvestrii* (see there), but other allies include *gabonensis* and related forms. Wheeler (1922) recorded *brevispinosa* from the stomachs of toads in Zaire under the name *T. mucidus*. This is just one of many misidentifications of *gabonensis*-group species which have occurred in the past, and earlier distribution records of these species should be treated with caution until the actual specimens can be checked.

MATERIAL EXAMINED.

IVORY COAST: Banco Forest (*W. L. Brown*). GHANA: Bunso (*D. Leston*); Tafo (*Strickland*); Tafo (*B. Bolton*); Mt Atewa (*B. Bolton*). NIGERIA: Gambari (*B. Bolton*). CAMEROUN: no loc. (*G. Terron*). GABON: Ile aux Singes (*J. A. Barra*). ZAIRE: Ituri Forest (*T. Gregg*); Boyulu (*H. O. Lang*); W. side Ruwenzori (*N. A. Weber*). UGANDA: Archip. Sesse (*E. Bayon*); Jinja (*G. Arnold*). SUDAN: Imatong Mts (*N. A. Weber*). CENTRAL AFRICAN REPUBLIC 'Ubangi Shari': Haut Mbomu (*N. A. Weber*). KENYA: Kaimosi Mission, NE. of Kisumu (*E. S. Ross & R. E. Leech*).

Triglyphothrix constanciae (Arnold)

Tetramorium (*Triglyphothrix*) *constanciae* Arnold, 1917 : 339, pl. 7, figs. 94, 94a. Syntype workers, RHODESIA: Matopo Hills, World's View, 23.v.1915 (*G. Arnold*) (BMNH; NM, Bulawayo; MCZ, Cambridge) [examined].

Triglyphothrix longispinosa Arnold, 1956 : 68, fig. 17. Paratype workers, RHODESIA: Chirinda Forest, 5.xi.1955 (*G. Arnold*) (NM, Bulawayo; BMNH) [examined]. **Syn. n.**

Worker. TL 3·0–3·6, HL 0·72–0·86, HW 0·70–0·84, CI 97–100, SL 0·48–0·54, SI 63–68, PW 0·52–0·64, AL 0·78–0·96 (12 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median, longitudinal carina. Propodeal spines long and acute, in profile two or more times longer than their basal width. Cephalic median carina well developed on the clypeus. Mandibles striate. Dorsal surfaces of head, alitrunk and petiole reticulate-rugulose, the postpetiole similarly but somewhat more faintly sculptured. Branched hairs dense everywhere, generally universally quadrifid on first gastral tergite, much more rarely with a few trifid hairs present. Elongate simple hairs absent from dorsal surfaces of head and body, and from appendages. Colour uniform mid-brown, the appendages lighter.

Closely resembling *gabonensis*, this species is distinguished by its smaller size, more strongly sculptured postpetiole and distinctly developed median clypeal carina. In *gabonensis* the postpetiole is generally smooth or with only vestigial sculpture and the median clypeal carina is poorly developed, or incomplete anteriorly, or more rarely absent. More distantly *constanciae* is related to *baufra* and *brevispinosa* but in these species the hairs on the first gastral tergite are universally trifid.

MATERIAL EXAMINED.

TANZANIA: Zanzibar, Mdo (*M. J. Way*).

***Triglyphothrix cryptica* sp. n.**

Holotype worker. TL 1·9, HL 0·52, HW 0·46, CI 88, SL 0·32, SI 70, PW 0·34, AL 0·52.

Antennae with 11 segments. Antennal scrobes strongly developed, with an acute dorsal margin and a marked median, longitudinal carina. Alitrunk in dorsal view short and broad, AL approximately 1·53 times PW. Propodeal spines short and acute, about as long as the metapleural lobes in profile. Dorsal surfaces of head, alitrunk and petiole finely reticulate-rugose, the spaces enclosed by the reticulae finely punctulate. Postpetiole and gaster smooth and shining; mandibles smooth with scattered small pits, not striate. Clypeus without a strong transverse carina crossing the median longitudinal carina. Antennal scapes with numerous short hairs and the leading edges also with a number of long, simple, erect or suberect curved hairs which are as long as or longer than the maximum width of the scape.

Dorsum of head with numerous branched hairs, usually trifid, and with long, simple hairs which are erect and very conspicuous, projecting far above the level of the branched hairs. Hairs of first gastral tergite predominantly a mixture of simple and bifid, but with a few trifid hairs also, particularly in the basal half. Outer surfaces of middle and hind tibiae without elongate, simple hairs. Colour black, the appendages yellow-brown.

Paratype workers. TL 1·9–2·1, HL 0·52, HW 0·46, CI 88, SL 0·30–0·32, SI 69–70, PW 0·32–0·34, AL 0·52 (2 measured). As holotype but colour somewhat lighter, a very dark brownish black. The mouthparts of one paratype were dissected, giving a palp formula of 3,3.

Holotype worker, GHANA: Mt Atewa, 31.vii.1969, primary forest (*D. Leston*) (BMNH).

Paratypes. 2 workers with same data as holotype (BMNH; MCZ, Cambridge).

This small species is closely related to *muscorum*, sharing the reduced antennomere count and palp formula. It differs from *muscorum* by being much darker in colour and lacking a transverse clypeal carina. *T. cryptica* tends to have a slightly broader head and longer antennal scapes than *muscorum*, at least in the material examined; compare the CI and SI above with *muscorum* CI 91–95, SI 57–64.

Triglyphothrix dedefra **sp. n.**

(Text-figs 48, 56)

Holotype worker. TL 2·3, HL 0·60, HW 0·56, CI 93, SL 0·42, SI 75, PW 0·38, AL 0·60.

Antennal scrobes strongly developed, in profile with an acute dorsal margin, a well-defined median longitudinal carina and a distinct ventral margin behind the eye. In front of the eye the ventral scrobe margin is less marked than behind. Eyes quite small, their maximum diameter about equal to the maximum width of the scape. Propodeal spines absent, in their place is a pair of broad, low, rounded tubercles which are less than half the size of the metapleural lobes. Node of petiole in dorsal view narrow, not anteroposteriorly compressed and transverse. Dorsum of head feebly longitudinally rugulose, shining, the rugulae irregular and broken in places. Dorsal alitrunk with sculpture almost effaced; a few faint, low rugulae are present but are superficial. First gastral tergite unsculptured but the petiole and postpetiole with traces of sculpture. Branched hairs numerous on all surfaces, universally trifid on the first gastral tergite. Elongate, simple hairs absent. Colour uniform light brown, shining.

Paratype workers. TL 2·3–2·5, HL 0·60–0·62, HW 0·54–0·58, CI 90–94, SL 0·42–0·44, SI 75–78, PW 0·36–0·40, AL 0·60–0·62 (3 measured). As holotype but two are slightly darker in colour and have the cephalic sculpture somewhat more strongly defined.

Holotype worker, ANGOLA: 7 mls W. Gabela, 16–18.iii.1972 (A30) (*P. M. Hammond*) (BMNH).

Paratypes. 3 workers with same data as holotype (BMNH; MCZ, Cambridge).

The absence of propodeal spines coupled with the lack of simple, elongate hairs and presence of very well developed antennal scrobes make this species quite conspicuous. The type-series was obtained from a berlese funnel sample of wet-forest litter.

Another specimen of this species is present in MCZ, Cambridge from UGANDA: (Kenya-Uganda border) Busnia (= Busia?), 17.ii.1948 (*N. A. Weber*). It is in rather poor condition and is not included in the type-series.

Triglyphothrix desertorum Forel

Triglyphothrix desertorum Forel, 1910*a* : 20. Syntype females, males, SOUTH WEST AFRICA: Kalahari, 'zwischen Kgokong und Kang' (*L. Schultze*) (MHN, Geneva; BMNH; MCZ, Cambridge) [examined].

This species remains known only from the series of females and males mentioned above. The females may very well be associated to the workers at present named *inezulae*, the queens of which are not known, and the males of *desertorum* and *inezulae* are certainly very similar.

In the *desertorum* females the scrobes are well developed, with a median longitudinal carina. Long, simple hairs are present on the upper edges of the dorsal scrobe margins which are longer than the neighbouring branched hairs, and the basal portion of the first gastral tergite has a band of punctate sculpturation. The pronotum is 'square-shouldered' in dorsal view and the propodeal spines are acute but quite short.

All these characters are also possessed by the worker caste of *inezulae*, but here the gastral hairs are trifid whilst in *desertorum* a number of bifid or even simple hairs are present.

There is little doubt in my mind that *inezulae* could very well be the worker caste of *desertorum*, but the differences in gastral pilosities may be of importance and so I have refrained from synonymizing the two. The solution to this problem must obviously await either the discovery of the worker caste of *desertorum* or the queen caste of *inezulae*, so that they can be directly compared.

Triglyphothrix distincta **sp. n.**

Holotype worker. TL 1·8, HL 0·46, HW 0·42, CI 91, SL 0·28, SI 66, PW 0·32, AL 0·52.

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median longitudinal carina. Ventral margin of scrobe well defined behind the eyes. Propodeal spines short and acute, about as long as the metapleural lobes. Promesonotum evenly and shallowly convex in profile, the propodeal dorsum sloping strongly towards the spines. Occipital margin of head shallowly indented medially in full-face view. Dorsum of head with fine, longitudinal rugulae which tend to form a weak reticulum on the extreme posterior portion. Alitrunk finely reticulate-rugose on pronotal dorsum and to some extent on the propodeum; on the mesonotum the rugulae tend to be longitudinal, with very few cross-meshes. Dorsum of petiole and postpetiole rugulose. Gaster unsculptured, smooth. Dorsal surfaces of head and alitrunk with numerous short, branched hairs and also with elongate simple hairs. Leading edge of antennal scape with a number of elongate simple hairs. Hairs on first gastral tergite simple. Colour distinctive, the head capsule, pedicel and gaster black, contrasting strongly to the yellow alitrunk, legs, antennae and mandibles.

Paratype workers. TL 1·7–1·9, HL 0·44–0·48, HW 0·40–0·44, CI 90–92, SL 0·26–0·28, SI 62–66, PW 0·28–0·34, AL 0·46–0·52 (7 measured). As holotype but some with the head and gaster blackish brown and the alitrunk a deeper shade than the clear pale yellow of the holotype. In the Mampong paratype series the head is somewhat more coarsely sculptured. One or two paratypes have a few bifid hairs basally on the first gastral tergite.

Holotype worker, GHANA: Tafo, 31.viii.1970, litter sample (*B. Bolton*) (BMNH).

Paratypes. 3 workers with same data as holotype, and 4 workers, 1 female, GHANA: Mampong, 26.i.1970 (*P. Room*) (BMNH; MCZ, Cambridge; MHN, Geneva).

This small, brightly coloured species is closest related to *minima* but this species is a uniform dark brown. Both series of *distincta* mentioned above came from samples of leaf-litter taken in dense forest. It is likely that this species nests in twigs in the litter layer. A similarly coloured species of *Tetramorium*, *T. flavithorax* Santschi, occurs sympatrically with *distincta* in West Africa but of course this species lacks branched hairs and has 11-segmented antennae and a spatulate appendage on the sting.

Triglyphothrix eminii Forel

(Text-figs 44, 45, 54)

Triglyphothrix eminii Forel, 1894 : 79. Syntype workers, ETHIOPIA: 'Südabessinien', Harar (*Ilg*) (MHN, Geneva) [examined].

Triglyphothrix marthae Forel, 1911 : 265. Holotype worker, TANZANIA: Zanzibar (ZM, Munich) [examined]. **Syn. n.**

Triglyphothrix marleyi Forel, 1914 : 221. Holotype worker, SOUTH AFRICA: Natal, Krantz Kloof, 24.v.1914 (*H. B. Marley*) (MHN, Geneva) [examined]. **Syn. n.**

Tetramorium (*Triglyphothrix*) *marleyi* var. *akermani* Arnold, 1926 : 276. Syntype workers, SOUTH AFRICA: Pietermaritzburg, 7.viii.1917 (*C. Akerman*) (BMNH; NM, Bulawayo) [examined]. **Syn. n.**

Triglyphothrix guillodi Santschi, 1937*a* : 231. Syntype workers, ANGOLA: Ebanga, no. 141, 26.ix.1932 (*Monard*) (MHN, CdF; NM, Basle) [examined]. **Syn. n.**

Triglyphothrix guillodi var. *mus* Santschi, 1937*a* : 232. Holotype worker, ANGOLA: Ebanga, no. 154 (*Monard*) (MHN, CdF) [examined]. **Syn. n.**

Triglyphothrix cinereus Weber, 1943 : 325, 377, pl. 16, fig. 25. Syntype workers, SUDAN: E. slopes of Imatong Mts, 4000 ft, 24.vii.1939 (*N. A. Weber*) (MCZ, Cambridge) [examined]. **Syn. n.**

Worker. TL 2·7–3·6, HL 0·62–0·74, HW 0·60–0·74, CI 97–103, SL 0·44–0·54, SI 69–75, PW 0·44–0·58, AL 0·68–0·82 (12 measured).

With the head in profile the antennal scrobes shallow and very poorly developed, scarcely extending beyond the level of the eye. Upper scrobe border not separated from dorsum of head by an acute margin, median longitudinal carina of scrobe absent or indistinguishable from surrounding sculpture. Branched hairs present within the scrobal area; the area occupied by the scrobe in other species is here almost as strongly sculptured as the remainder of the head. Propodeal spines short and acute, very small in some specimens. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugulose, the gaster unsculptured; mandibles striate. Dorsal surfaces of head and body densely clothed with branched hairs, universally quadrifid on the first gastral tergite. Elongate, simple hairs absent except for a few on the mouthparts. Colour brown, usually dark brown, sometimes with gaster darker than head and alitrunk.

Widely distributed in savannah and relatively dry forest in Africa, and also occurring on the coastal plains and cleared forest areas of West Africa, this species has been found nesting amongst the roots of small trees and shrubs in Nigeria and Ghana. It is allied closely to *agna* which also has reduced scrobes, but in this last-named species the propodeum lacks spines. A third species, *rothschildi*, also occurs in Africa and has the scrobes completely absent, no trace of them remaining, but here the anterior clypeal margin is strongly excised and the species is much larger than either *agna* or *eminii*.

MATERIAL EXAMINED.

GHANA: Legon (*D. Leston*). NIGERIA: Gambari (*B. Bolton*). SUDAN: Imatong Mts (*N. A. Weber*). KENYA: Diani Beach (*N. L. H. Krauss*). SOUTH AFRICA: Durban (*G. Arnold*); Natal, Krantz Kloof (*G. Arnold*); Durban (*H. B. Marley*).

Triglyphothrix furtiva Arnold

Triglyphothrix furtiva Arnold, 1956 : 69, fig. 18. Syntype worker, females, RHODESIA: Vumba Mts, 9.xi.1953 (*G. Arnold*) (NM, Bulawayo) [examined].

Worker. TL 2·2–2·5, HL 0·54–0·62, HW 0·50–0·56, CI 90–96, SL 0·34–0·40, SI 68–73, PW 0·36–0·42, AL 0·54–0·64 (16 measured).

Antennal scrobes strongly developed, with acute dorsal margins and well-defined posterior and ventral margins. Median longitudinal carina of scrobe strong, reaching back well beyond the posterior margin of the rather small eye. In a few specimens the carina almost reaches the posterior border of the scrobe. Alitrunk short and compact in profile, the propodeal dorsum sloping behind to the short, acute propodeal spines. Dorsum of head finely longitudinally rugulose, with cross-meshes forming a rugoreticulum posteriorly. Mandibles longitudinally striate. Antennal scrobes shining, without sculpture or at most with a weak punctulation. Dorsal alitrunk predominantly irregularly longitudinally rugulose, the fine rugulae often wavy or meandering. Nodes of pedicel reticulate. Gaster mostly smooth and shining but the basal portion generally with a few scattered, very small punctures. Branched hairs abundant everywhere, predominantly trifid but usually with a number of bifid hairs on the first gastral tergite, the proportions of bifids to trifids tending to vary between series. Elongate, simple hairs absent except around the mouthparts and in a spaced row along the upper margin of the scrobe. The hairs in this row are shorter than in some related species and tend to project laterally to some extent. Nevertheless, they are longer and somewhat stouter than their branched neighbours. Colour black or blackish brown, the appendages lighter.

A small, wet-forest inhabiting species which is widely distributed in Africa. Like a number of other small species the palp formula here is 3,3, but this is not accompanied by a reduction of the antennomere count to eleven. It has been found nesting in leaf mould below a rotten log in Ghana and foragers have been found in leaf-litter in all the localities listed below, either by free collecting or by use of a berlese funnel. In the original description Arnold stated that the type-series was captured 'under dead leaves in damp ground in a forest'. The underside of the data-label of the type states 'in forest at Mountain Lodge Hotel'.

MATERIAL EXAMINED.

GHANA: Tafo (*B. Bolton*); Tafo (*D. Leston*); South Scarp Forest (*W. Gotwald*). CAMEROUN: Ototomo (*G. Terron*). GABON: Plateau d'Ipassa (*J. A. Barra*). ANGOLA: Gabela (*P. M. Hammond*); Salazar (*P. M. Hammond*); Kahingo (*Mwaoko*); R. Camudembole (*L. de Carvalho*).

Triglyphothrix gabonensis André

(Text-fig. 60)

Triglyphothrix gabonensis André, 1892 : 53. Syntype worker, female, male, GABON (*Mocquerys*) (MNHN, Paris) [examined].

Triglyphothrix gabonensis st. *soyauxi* Forel, 1901 : 53. Holotype female, GABON: Ssibange (*Soyaux*) (NM, Hamburg). **Syn. n.**

Triglyphothrix mucidus Forel, 1909 : 71. Syntype workers, ZAIRE: Kasai, Sankuru (*Luja*) (MHN, Geneva) [examined]. **Syn. n**

Triglyphothrix areolatus Stitz, 1910 : 142, fig. 9. Syntype workers, CAMEROUN: Bibundi, 15–30.iv.1905 (*Tessmann*) (MNHU, Berlin) [examined]. **Syn. n.**

Triglyphothrix gabonensis var. *boulognei* Forel, 1916 : 423. Syntype workers, ZAIRE (*Kohl*) (MHN, Geneva) [examined]. **Syn. n.**

Triglyphothrix gabonensis subsp. *soyansi* Forel; Emery, 1922 : 273. [Misspelling.]

Triglyphothrix areolata var. *burgeoni* Santschi, 1935 : 265. Syntype workers, ZAIRE: Haut Uelé, Moto, 1920 (*L. Burgeon*) (MRAC, Tervuren; NM, Basle) [examined]. **Syn. n.**

Triglyphothrix gabonensis var. *kamerunensis* Santschi, 1937*b* : 102. Holotype worker, CAMEROUN: Buea, Kamerunberg, 12.xi.1935 (*F. Zumpt*) (NM Basle) [examined]. **Syn. n.**

Worker. TL 3·8–4·6, HL 0·94–1·16, HW 0·90–1·10, CI 92–98, SL 0·68–0·76, SI 68–75, PW 0·60–0·72, AL 0·92–1·20 (25 measured).

Anterior clypeal margin with a small median indentation, impression or notch, varying in size in different populations. Median carina of clypeus weakly developed, usually only well marked on the posterior portion, tending to fade out anteriorly; very rarely it is completely absent. Antennal scrobes with a sharp dorsal margin, the median longitudinal carina of the scrobes generally poorly developed though usually visible; rarely is it indistinguishable from the sculpture above the eye. Dorsal outline of alitrunk in profile generally showing a long and extremely shallow concavity over the posterior portion of the mesonotum and anterior propodeum. Propodeal spines long and acute, the metapleural lobes low and rounded, rarely triangular. Dorsal surfaces of head, alitrunk and petiole usually finely and quite superficially rugulose and shining, more rarely with rather coarser sculpture, but the postpetiole less strongly sculptured. Mandibles striate, the gaster unsculptured. Dorsal surfaces of head and body densely clothed with branched hairs, those on the first gastral tergite universally quadrifid. Elongate simple hairs absent from dorsum of head and appendages.

Ranging through the forests of Central Africa and into Uganda and Sudan, this is one of the largest species in the genus and the characters noted above make it quite conspicuous. The species closest related to *gabonensis* is *constanciae*, the differences separating them are given under the latter name.

MATERIAL EXAMINED.

CAMEROUN: Ikiliwindi (*C. A. Collingwood*); Mt Kala (*G. Terron*); Matute (*B. Malkin*). GABON: Plateau d'Ipassa (*J. A. Barra*); Makokou (*I. Lieberburg*) ZAIRE: Kai Bumba (*H. Schouteden*); Mayumbe, Zobi (*R. Mayné*); Mayumbe (*R. Mayné*); Ituri, Akenge (*Lang & Chapin*); N'Gayu (*Lang & Chapin*); Itoka (*Mayné*); Lundu (*H. Schouteden*); Mongende (*H. Schouteden*); Avakubi (*Bequaert*); Yambuya (*Bequaert*); Yangambi (*N. L. H. Krauss*); Ituri Forest, vic. Epulu (*T. Gregg*); Walikali (*E. S. Ross & R. E. Leech*). UGANDA: Jinja (*E. S. Ross & R. E. Leech*). SUDAN: Imatong Mts. (*Weber*).

Triglyphothrix gestroi Menozzi

Triglyphothrix gestroi Menozzi, 1932 : 105, fig. 3. Syntype workers, UGANDA: Victoria Nyanza, Archip. de Sesse, Bugala, 1908 (*E. Bayon*) (IE, Bologna) [examined].

Worker. TL 1·8–2·1, HL 0·44–0·52, HW 0·42–0·48, CI 89–95, SL 0·28–0·32, SI 64–69, PW 0·32–0·38, AL 0·52–0·58 (12 measured).

Antennal scrobes well-developed, shining, with an acute dorsal margin and a distinct median longitudinal carina. Alitrunk in profile with the promesonotum more or less flat to feebly convex, the propodeum sloping strongly to the acute spines. Dorsal surfaces of head, alitrunk and petiole closely and finely reticulate-rugose, the postpetiole more feebly so. Mandibles striate; gaster unsculptured, smooth and shining. All surfaces of head, body and appendages with numerous short, branched hairs. Dorsal surfaces of upper scrobe margins with a series or spaced row of elongate, simple hairs. These are not as long as in some related species and consequently are less conspicuous, but they are generally 1·5–2·0 times longer than the neighbouring branched hairs. The leading edges of the scapes and outer margins of the tibiae lack such simple hairs. Colour yellow, usually light, the gaster generally a darker shade.

This minute species bears a close relationship to *furtiva* and has a similar distribution. However, *furtiva* is larger, black, and tends to have the rugulose sculpturing of the head and alitrunk more widely spaced and more distinctly longitudinal in organisation.

Along with *cryptica* and *muscorum*, *gestroi* shares the reduced palp formula of 3,3 but lacks the corresponding reduction in antennomere count. The species inhabits wet-forest areas in central and eastern Africa, but has not yet been found in the West African forests. All collections of this species examined have been made from leaf-litter and the species apparently nests there as the long series from Uganda, noted below, bears the data 'Litter and humus under hardwoods in dense forest'.

MATERIAL EXAMINED.

UGANDA: Bundibugyo (*G. O. Evans*). GABON: Plateau d'Ipassa (*J. A. Barra*). ANGOLA: Mouth of R. Mussungue (*Luna de Carvalho*); Salazar (*P. M. Hammond*); Dundo, Carrisso Park ('native collector'); Route Saurimo-Luso (*Luna de Carvalho*); route Dundo-Saurimo (*L. de Carvalho*).

Triglyphothrix imbellis Emery

Triglyphothrix imbellis Emery, 1915*a* : 18, fig. 9. Holotype worker, ETHIOPIA: Eritrea, Nefasit (*F. Silvestri*) (MCSN, Genoa).

I have not been able to examine the holotype of this species, nor have I seen any other material which may be referred to *imbellis*. In the original description Emery makes it quite plain that this species is very closely related to and may even be a subspecies of *auropunctatus* (now a synonym of *microps*). In the light of these statements *imbellis* is presently regarded as a good species, very close to *microps* but separated from it by lack of acute propodeal spines, which in *imbellis* are represented by a pair of low, rounded tubercles.

Triglyphothrix inezulae Forel

(Text-fig. 40)

Triglyphothrix inezulae Forel, 1914 : 221. Syntype workers, male, SOUTH AFRICA: Natal, Durban, Beach Bush, 15.i.1914 (*G. Arnold*) (MHN, Geneva; BMNH; MCZ, Cambridge) [examined].

Tetramorium (*Triglyphothrix*) *hepburni* Arnold, 1917 : 340. Syntype workers, females, males, RHODESIA: Bulawayo, Hillside, 10.iv.1915 (*G. Arnold*) and Bulawayo, Hillside, 23.i.1916 (*G. Arnold*) (BMNH; NM, Bulawayo) [examined]. **Syn. n.**

Triglyphothrix hepburni subsp. *mashonana* Arnold, 1949 : 266, fig 7a. Holotype and paratype workers, RHODESIA: Mashonaland, Hunyáni, 30.i.1948 (*G. Arnold*) (BMNH; NM, Bulawayo) [examined]. **Syn. n.**

Worker. TL 2·5–3·3, HL 0·60–0·80, HW 0·54–0·78, CI 90–97, SL 0·38–0·52, SI 67–74, PW 0·40–0·58, AL 0·60–0·88 (12 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and a strong median longitudinal carina. Propodeal spines short and acute, usually about as long as their basal width in profile, occasionally longer. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the sculpture generally more strongly defined in smaller individuals. Base of first gastral tergite with a transverse band of dense and usually coarse punctures, the apical portion of the tergite lacking such sculpture. Entire body with numerous branched hairs, which are predominantly or universally trifid on the first gastral tergite. Elongate, simple hairs which are much longer than the neighbouring branched hairs are present on the mouthparts and in a spaced row along the dorsal surface of the upper margin of the antennal scrobe. Colour uniform medium to dark brown.

The closest relative of *inezulae* is certainly the minute species *trimeni*, also found in southern Africa. The two are separable as *trimeni* is very small and has the lower portion of the scrobe poorly developed, the median carina of the scrobe being indistinguishable from other rugulae which occur in the vicinity. In *inezulae* the lower portion of the scrobe is strongly developed and only very weakly sculptured so that the median carina of the scrobe is very distinctive.

The names given in synonymy above represent three sizes in what turns out to be a continuous size-range in this rather variable species. The main difference separating *hepburni* from *inezulae* was the relative sizes of the specimens, *hepburni* being smaller (largest measured had HL 0·66, HW 0·62), and *inezulae* larger (smallest measured had HL 0·74, HW 0·70). The types of *mashonana*, when measured, bridged this gap nicely by falling directly between the largest *hepburni* and smallest *inezulae*, having measurements in the order of HL 0·70, HW 0·66.

MATERIAL EXAMINED.

TANZANIA: Mt Meru (*E. S. Ross & R. E. Leech*). ZAIRE: Mutshatsha (*E. S. Ross & R. E. Leech*). RHODESIA: Bulawayo (*G. Arnold*); Bulawayo, Hillside (*G. Arnold*); Matopos (*G. Arnold*); Lonely Mines (*H. Swale*).

Triglyphothrix menkaura sp. n.

(Text-figs 41, 46, 47, 55)

Holotype worker. TL 2·4, HL 0·56, HW 0·54, CI 96, SL 0·38, SI 70, PW 0·42, AL 0·62.

Antennal scrobes strongly developed, deep, with an acute dorsal margin and sharply defined posterior border. Ventral margin of scrobe well developed behind eye, the median longitudinal carina narrow but distinct, extending to the posterior margin of the eye. Clypeus with a transverse carina crossing the median longitudinal carina (this is better developed in the holotype than in some of the paratypes). Dorsal alitrunk evenly convex in profile, sloping behind to the propodeal declivity. Propodeal spines absent, in their place a pair of very low, broad, rounded tubercles, considerably smaller than the metapleural lobes. Mandibles striate. Head virtually unsculptured except for the median carina, smooth and shining with a few minute, superficial rugulae and fine punctures from which hairs arise. Dorsal surfaces of alitrunk, pedicel and gaster unsculptured apart from minute hair-pits, smooth and shining. All dorsal surfaces with numerous branched, short hairs; the upper surfaces of the dorsal scrobe margins also with a spaced row of elongate, simple hairs. First gastral tergite with a mixture of simple and bifid hairs. Trifid hairs rare or absent but present at least on alitrunk and pedicel where simple and bifid forms are also present. Colour a deep blackish brown everywhere.

Paratype workers. TL 2·3–2·4, HL 0·56–0·58, HW 0·54, CI 93–96, SL 0·36–0·38, SI 67–70, PW 0·40–0·44, AL 0·62–0·64 (6 measured). As holotype.

Holotype worker, GHANA: Tafo, 7.vi.1970, twig in leaf-litter (*B. Bolton* (BMNH).

Paratypes. 6 workers and 2 alate females, same data as holotype (BMNH; MCZ, Cambridge; MHN, Geneva).

The only species of *Triglyphothrix* yet known in which the body is mostly unsculptured and smooth and which lacks propodeal spines yet retains elongate simple hairs on the head. The first two of these characters are also shown in *dedefra* but this species lacks simple cephalic hairs.

The nest from which the type-series was taken was situated in a small piece of rotten twig embedded in deep leaf-litter in a cocoa plot.

Triglyphothrix microps Mayr

(Text-figs 43, 53)

Triglyphothrix microps Mayr, 1901 : 25. Syntype worker, female, SOUTH AFRICA: Port Elizabeth (*H. Brauns*) (BMNH) [examined].

Triglyphothrix auropunctatus Forel, 1910*a* : 20. Syntype workers, female, SOUTH AFRICA: Natal, 2500 ft, no. 211 (*Haviland*) (MHN, Geneva; MCZ, Cambridge) [examined]. **Syn. n.**

Triglyphothrix auropunctatus var. *pallens* Forel, 1910*b* : 424. Syntype workers, SOUTH AFRICA: Natal (*Haviland*) (MHN, Geneva) [examined]. **Syn. n.**

Triglyphothrix auropunctatus var. *fusciventris* Forel, 1913*a* : 116. Syntype workers, RHODESIA (*G. Arnold*) (MHN, Geneva; MCZ, Cambridge) [examined]. **Syn. n.**

Triglyphothrix auropunctatus var. *rhodesiana* Forel, 1913*b* : 221. Syntype females, RHODESIA: Bembesi, 1912 (*G. Arnold*) (MHN, Geneva) [examined]. **Syn. n.**

Tetramorium (*Triglyphothrix*) *auropunctatus* var. *bulawayensis* Arnold, 1917 : 335. Syntype workers, RHODESIA: Bulawayo, 12.vii.1913 (*G. Arnold*) (BMNH) [examined]. **Syn. n.**

Worker. TL 3·4–3·7, HL 0·64–0·72, HW 0·60–0·68, CI 90–97, SL 0·40–0·44, SI 62–70, PW 0·44–0·50, AL 0·64–0·74 (12 measured).

Eyes very small, their maximum diameter distinctly less than the maximum width of the scape. Antennal scrobes well developed, their dorsal margins acute, usually also well defined posteriorly but the lower margin behind the eye not so strongly defined. Median longitudinal carina of scrobe distinct. Propodeum armed with a pair of acute, triangular spines, the metapleural lobes rounded in profile, not elongate or dentiform. Dorsum of head rugose, tending to be more or less longitudinal but often with reticulation posteriorly. Dorsum of alitrunk and pedicel irregularly rugulose, most or all the rugulae longitudinal in direction on the alitrunk. Postpetiole generally less strongly sculptured than petiole. Mandibles striate. All dorsal surfaces with numerous branched hairs, predominantly trifid on first gastral tergite but often with a few bifid or simple hairs present. Dorsum of upper margin of antennal scrobe with a spaced row of elongate, simple hairs which are much longer than their branched neighbours. Colour yellow to yellow-brown, a few specimens darker brown, often with the gaster somewhat darker than the head and alitrunk.

Arnold (1917) records this species nesting in or near the galleries of *Platythyrea cribrinodis* (Gerstaecker), 'apparently in plesiobiosis'. The closest relative of *microps*, *arnoldi*, has also been found amongst the galleries of larger ponerine species. The two are easily separable as *arnoldi* lacks branched hairs and has the dorsal alitrunk densely reticulate-punctate.

MATERIAL EXAMINED.

RHODESIA: Bembesi (*G. Arnold*); Shiloh (*G. Arnold*); Matopos (*G. Arnold*); Bulawayo (*G. Arnold*). SOUTH AFRICA: Algoa Bay (*H. Brauns*); Grahamstown (*J. Hewitt*); Natál (*Haviland*); Cape Prov., Balfour (*E. S. Ross & R. E. Leech*); Cape Prov., Umtata (*E. S. Ross & R. E. Leech*). ANGOLA: Bruco (*P. M. Hammond*).

***Triglyphothrix minima* sp. n.**

Holotype worker. TL 2·0, HL 0·46, HW 0·40, CI 87, SL 0·28, SI 70, PW 0·30, AL 0·48.

Antennal scrobes well developed and deep, with acute and well-defined dorsal, posterior and ventral margins behind the eyes. Median longitudinal carina of scrobe extending beyond the posterior margin of the eye. Promesonotal dorsum in profile evenly convex, the propodeal dorsum sloping posteriorly to the short, acute propodeal spines. Mandibles smooth with the rugulae become more crowded and some reticulation may be developed. Dorsal surfaces of alitrunk and pedicel rugulose, the latter more closely so than the former. Gaster smooth, scattered small punctures, not striate. Head finely longitudinally rugulose; on the anterior portion the rugulae are very spaced out, with only 4 or 5 on each side between the cephalic median carina and the upper scrobe margin. On the extreme posterior portion of the head unsculptured. Branched hairs present but relatively sparse on head, alitrunk and pedicel, generally bifid and short. Elongate simple hairs present in a row along the leading edge of the scape, and on the head and dorsal alitrunk. Hairs of first gastral tergite predominantly simple, with a few bifid hairs basally. Colour uniform dark brown, the appendages lighter.

Paratype workers. TL 1·7–2·0, HL 0·42–0·46, HW 0·38–0·40, CI 86–90, SL 0·26–0·28, SI 69–70, PW 0·28–0·30, AL 0·44–0·50 (5 measured). As holotype.

Holotype worker, GHANA: Kumasi, 15.i.1969, in termite nest (*B. Bolton*) (BMNH).

Paratypes. 2 workers with same data as holotype. 5 workers, GHANA: Mampong 26.i.1970 (*P. Room*). 1 worker, NIGERIA: Ibadan, I.I.T.A., 8–11.vii.1974 (*B. R. Critchley*) (BMNH; MCZ, Cambridge).

The closest known relative of this minute species is *distincta*, also from West Africa, but this species is strikingly coloured black and yellow and is easily distinguished. The holotype and two paratype workers from Kumasi were in the walls of a small termite colony in a rotten log. It is not possible to say whether this species is termitolestic or not as the workers may just have been foraging in the termite log quite accidentally.

Three series of specimens from IVORY COAST: Abidjan, Banco Forest, i.1963; 9.i.1963, no. A13; 10.i.1963, no. A33 (*W. L. Brown*) which are deposited in MCZ, Cambridge also represent this species. They all fit the above description except that in series A13 the sculpture on the dorsal alitrunk is reduced and effaced so that the surface is mostly smooth with only traces of sculpture remaining. In series A33 the sculpture is more distinct and these form a link between the more strongly sculptured type-series and the less strongly sculptured individuals.

Triglyphothrix monardi Santschi

Triglyphothrix monardi Santschi, 1937*a* : 230, figs 1, 2. Holotype worker, ANGOLA: Ebanga, no. 154, xi. 1932 (*Monard*?) (MHN, CdF) [examined].

Holotype worker. TL 4·0, HL 0·90, HW 0·90, CI 100, SL 0·60, SI 67, PW 0·70, AL 1·02. Antennal scrobes well developed, with an acute dorsal margin and a marked median longitudinal carina. Propodeal spines long, strong and acute, the metapleural lobes short and rounded. Node of petiole massively developed, its maximum width in dorsal view ca 0·48. Shape in dorsal view thickly and bluntly crescentic, the anterior margin broadly convex, the posterior somewhat concave so that the blunt 'horns' of the crescent are directed posterolaterally. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the mandibles striate. Basal portion of first gastral tergite with a transverse band of enlarged but shallow punctures, this area distinctly more strongly sculptured than the remainder of the gaster. Elongate, simple hairs absent from head, body and appendages; entirely covered in a dense coat of branched hairs. First gastral tergite with a mixture of trifid and quadrifid hairs. Colour dark brown.

The closest relatives of this species, which is known only from the holotype worker, are certainly *gabonensis*, *brevispinosa* and their allies. In these species, however, the petiole node is not so markedly developed as in *monardi* and the disc of the first gastral tergite has only trifid or quadrifid hairs, not a mixture of both. The presence of a band of punctate sculpture on the base of the first gastral tergite may be variable in extent and intensity, as is the case in *brevispinosa*, but it will separate *monardi* from all specimens of *gabonensis* examined during the course of this study, none of which possessed the punctate area.

Triglyphothrix muscorum (Arnold)

Tetramorium (*Triglyphothrix*) *muscorum* Arnold, 1926 : 274, fig. 78. Syntype workers, MOZAMBIQUE: Amatongas Forest, 13.ii.1917 (*G. Arnold*) (BMNH; MCZ, Cambridge; NM, Bulawayo) [examined].

Worker. TL 1·6–1·9, HL 0·44–0·48, HW 0·40–0·46, CI 91–96, SL 0·24–0·28, SI 57–64, PW 0·32–0·36, AL 0·44–0·52 (10 measured).

Antennae with 11 segments. Scrobes strongly developed, with distinct margins and a marked median longitudinal carina. Propodeal spines short and acute, about as long as the metapleural lobes. Petiole in profile with a short, thick anterior peduncle. Palp formula 3,3, the basal segment of the maxillary palp short and indistinct. Dorsal surfaces of head, petiole and postpetiole reticulate-rugose. This sculpture may be reduced on the postpetiole but is always present. Mandibles smooth with scattered pits, not striate; gaster unsculptured. Clypeus with a distinct transverse carina crossing the median longitudinal carina. Leading edges of antennal scapes with a number of long, simple hairs which are as long as or longer than the maximum width of the scape. Dorsum of head with numerous branched hairs and with a number of long, simple hairs, especially on the upper surface of the dorsal scrobe margin. These simple hairs are markedly longer than the neighbouring branched hairs and are very conspicuous. Colour yellow-brown, usually with the gaster darker but the colour uniform in some populations.

This small species is widespread in forested areas throughout Africa and is closely related to *cryptica*, a species known at present only from Ghanaian primary forest. The differences separating these two species are given under *cryptica*. Most of the samples examined were from berlese funnel extracts of forest leaf-litter, but in the original description Arnold noted that 'the nest was placed in moss which covered the bark of a large tree growing in the depths of the forest'.

MATERIAL EXAMINED.

IVORY COAST: Divo (*L. Brader*). GHANA: Tafo (*B. Bolton*). UGANDA: F. Portal (*N. A. Weber*). CAMEROUN: No. V6 (no. loc.) (*G. Terron*). GABON: Plateau d'Ipassa (*J. A. Barra*). ANGOLA: R. Camudembele (*Luna de Carvalho*); Dundo, Carrisso Park ('native collector'). CENTRAL AFRICAN REPUBLIC: Ubangi Shari, Haut Mbomu (*N. A. Weber*). ZAIRE: W. side Ruwenzori (*N. A. Weber*); Ituri For., Beni Irumu (*N. A. Weber*).

***Triglyphothrix osiris* sp. n.**

(Text-fig. 61)

Holotype worker. TL 2·9, HL 0·70, HW 0·64, CI 91, SL 0·46, SI 72, PW 0·52, AL 0·72.

Antennal scrobes well developed, with acute margins dorsally, posteriorly and ventrally both in front of and behind the eyes. Median longitudinal carina of scrobe strongly marked, extending well beyond the posterior margin of the eye. Alitrunk convex dorsally, sloping more steeply posteriorly than anteriorly. Propodeal spines long and very narrow, scarcely tapered from base to apex and feebly downcurved along their length. Mandibles smooth, unsculptured except for a few scattered small pits. Head with sculpture almost completely effaced and quite shining, here and there with minute and very faint superficial rugulae and a few hair pits. Dorsal surfaces of alitrunk and pedicel finely reticulate-rugulose, the spaces between the rugulae finely punctate. Gaster unsculptured. All surfaces of head, body and appendages with abundant branched hairs, those on the first gastral tergite predominantly quadrifid but with a number of trifid hairs also present. Leading edges of antennal scapes with a number of very long, simple hairs, considerably longer than their branched neighbours, the longest of them greater than the maximum width of the scape. Dorsal surface of head also with very long, simple hairs and some are present on the dorsal alitrunk. On this last-named surface the simple hairs are less conspicuous as the branched hairs are longer than on the head. Colour brown, the alitrunk and pedicel a much lighter shade than the gaster, which is very dark brown.

Paratype workers. TL 2·8–2·9, HL 0·68, HW 0·62–0·64, CI 91–94, SL 0·44–0·46, SI 71–72, PW 0·48–0·52, AL 0·70–0·74 (2 measured). As holotype.

Holotype worker, GHANA: Mt Atewa, 10.vii.1968, in leaf-litter (*B. Bolton*) (BMNH).

Paratypes. 2 workers with same data as holotype (BMNH; MCZ, Cambridge).

The diagnosis above will serve to separate this species from all others in the Ethiopian region. In some respects *osiris* resembles the tramp species *lanuginosa*, but in this species the branched hairs are primarily bifid, mixed with simple hairs, whilst in *osiris* the branched hairs are trifid and quadrifid and very dense. Finally, in *lanuginosa* the mandibles are striate in all but the smallest individuals whereas in *osiris* they are smooth.

For the present *osiris* is dubiously grouped with *reptana* and *yarthiella* (see list of species) but it may well have its origins in a different group, perhaps the *gabonensis*-group.

Triglyphothrix paupera Santschi

Triglyphothrix pauper Santschi, 1917 : 286. Syntype workers, RHODESIA: Umgusa, Cawston Farm (*G. Arnold*) (NM, Basle; BMNH; MCZ, Cambridge) [examined].

Tetramorium ericae Arnold, 1917 : 332. Syntype workers, RHODESIA: Bulawayo, Hillside, 28.iii.1915 (*G. Arnold*) (BMNH; MCZ, Cambridge; NM, Bulawayo) [examined]. **Syn. n.**

Worker. TL 1·8–2·0, HL 0·48–0·54, HW 0·42–0·48, CI 88–92, SL 0·26–0·32, SI 60–69, PW 0·30–0·38, AL 0·48–0·56 (10 measured).

Upper portion of antennal scrobes strongly developed, with an acute dorsal margin. Usually the lower portion of the scrobe best developed behind the eye, the latter being large in this species. Median longitudinal carina of scrobe developed, usually running beyond the posterior margin of the eye. Propodeal spines distinct, as long as or slightly longer than their basal width, acute. Sculpture on head and dorsal alitrunk a loose and rather spaced-out rugosity, tending to be longitudinal on most of the head but reticulate posteriorly. The alitrunk may be reticulate everywhere or the rugulae may become longitudinal behind the pronotum. Petiole dorsum more strongly sculptured than postpetiole, the latter sometimes almost smooth. Gaster unsculptured. Dorsal surfaces of head and body with numerous short, branched hairs, first gastral tergite with a mixture of bifid and simple hairs, the former predominating; trifid hairs apparently absent. Elongate, simple hairs which are much longer than their branched neighbours are present on the leading edge of the scape, in a spaced row along the dorsal surface of the upper scrobe margin and on the dorso-lateral margins of pro- and mesonotum. Colour yellow to mid-brown, often with gaster darker than alitrunk and head.

In his original description of this species Arnold (1917) failed to notice the presence of branched hairs and consequently placed it in *Tetramorium*, saying that it was 'intermediate in structure between *Tetramorium* s.str. and its subgenus *Triglyphothrix*'. Later Arnold (1926) re-examined his *ericae* specimens and noted that bifid hairs were present. *T. ericae* is, however, an absolute synonym of ***paupera***, and the diagnostic notes above will isolate the species from its closest relatives.

MATERIAL EXAMINED.

RHODESIA: Sawmills (*G. Arnold*); Bulawayo, Hillside (*G. Arnold*).

Triglyphothrix pulcherrima Donisthorpe

(Text-fig. 59)

Triglyphothrix pulcherrima Donisthorpe, 1945 : 76. Syntype workers, UGANDA: Kampala, Nambazidza Forest, 3.iv.1926 (*G. L. R. Hancock*) (BMNH) [examined].

Worker. TL 2·7, HL 0·68, HW 0·66–0·68, CI 97–100, SL 0·42, SI 62–64, PW 0·56, AL 0·74–0·76 (2 measured).

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median longitudinal carina. Alitrunk short and very broad across the pronotum in dorsal view, in profile the dorsum strongly convex. Propodeal spines short and acute. Petiole in dorsal view somewhat broader than long but not markedly transverse. Mandibles striate. Dorsal surfaces of head and alitrunk finely and densely reticulate-rugulose. Dorsum of pedicel similarly sculptured but the rugulae tending to be more longitudinal, especially on the postpetiole. Base of first gastral tergite finely longitudinally striate. Head, body and appendages abundantly covered with short, branched hairs; simple hairs apparently present on mouthparts and gastral apex. Head, antennae and mandibles bright yellow, contrasting strongly to the remainder of the body which is black or very deep blackish brown. Legs brown.

The striking colouration of this medium-sized species is its most obvious feature and is immediately reminiscent of *fulviceps* of New Guinea. I am sure that this similarity in colour and also in sculpturation is due to convergence as the shapes of the petiole nodes in the two species are fundamentally different. In *pulcherrima* the node in profile is high and narrow, with long anterior and posterior faces and a short, convex dorsal face whilst in *fulviceps* the node is long and low in profile, with the anterior face very short and merging into the peduncle (compare Text-figs 59 and 62).

The distinctive colour pattern of *pulcherrima* will easily distinguish the species from any other in the Ethiopian region. The only other strongly bicoloured African species is *distincta*, but in this case the head, gaster and usually the pedicel are black whilst the alitrunk is clear yellow. There are numerous other differences as comparison of the descriptions will show.

MATERIAL EXAMINED.

ZAIRE: Ituri Forest, Beni-Iruma (*N. A. Weber*).

Triglyphothrix reptana **sp. n.**

Holotype worker. TL 3·4, HL 0·74, HW 0·70, CI 94, SL 0·50, SI 71, PW 0·56, AL 0·82.

Antennal scrobes very strongly developed and deep, bordered above by a narrow, flange-like extension of the frontal carinae and bordered posteriorly and ventrally by an acute and prominent ridge which is strongest ventrally in the space between the eye and the mandibular articulation. Median longitudinal carina of scrobe strong, acute, reaching back almost to the posterior border of the scrobe, well behind the level of the eye. Alitrunk in profile strongly and evenly convex, the propodeum armed with a pair of short, stout spines which are longer than the rounded metapleural lobes. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely, densely and shallowly reticulate-rugulose, the sculpture on the head weaker than on the alitrunk, that on the postpetiole weaker than on the petiole. Gaster unsculptured. Entirety of head, body and appendages very densely clothed in branched hairs. On the first gastral tergite they are predominantly quadrifid but are so close-packed that the outlines of individual hairs are difficult to see. Elongate erect simple hairs are mostly absent, present only on the mouthparts and clypeus and with a row along the leading edges of the antennal scapes. Apart from these there is a single pair at the posterior extremity of the scrobes and another pair close to the midline of the dorsum of the head at about the level of the anterior eye margins when the head is viewed in profile. Colour uniform light yellowish brown.

Holotype worker, UGANDA: 10 miles W. Jinja, 1200 m, 1.xii.1957 (*E. S. Ross & R. E. Leech*) (BMNH).

This species is easily characterised by the odd distribution of erect long, simple hairs coupled with the extremely strongly developed antennal scrobes. It shows resemblances to *osiris* and *menkaura* but both of these show a row of simple hairs along the upper scrobe margins.

Triglyphothrix rothschildi Forel

(Text-figs 42, 52)

Triglyphothrix rothschildi Forel, 1907 : 134. Holotype worker, ETHIOPIA: Harrar, mars 1905 (*M. de Rothschild*) (MNHN, Paris) [examined].

Worker. TL 3·8–4·7, HL 1·00–1·34 (measured from clypeal apex, not from base of impression), HW 1·00–1·34, CI 100–104, SL 0·62–0·86, SI 62–66, PW 0·64–0·84, AL 0·86–1·20 (8 measured).

Median portion of clypeus with the anterior margin broadly and deeply excavated, concave. Antennal scrobes completely absent, the area which they occupy in other species is here as strongly sculptured as the remainder of the head and has numerous branched hairs arising from it. Pronotum square-shouldered in dorsal view, the propodeum armed with a pair of acute spines. Node of petiole in dorsal view about as broad as long, with more or less straight anterior and posterior faces and the sides diverging posteriorly so that the node is broader behind than in front. Head and alitrunk finely rugose dorsally, with a tendency for the rugae to be longitudinal, the petiole and postpetiole rugose dorsally. First gastral tergite with the basal portion longitudinally striate, often with very fine punctures between the striae. Elongate, simple hairs present only on mouthparts and gastral apex, and a few on the cephalic dorsum, elsewhere the head and body with numerous branched hairs which tend to be closely applied on the head. Colour red-brown.

Apparently widely though sporadically distributed in dry or semi-desert localities, this large distinctive species is one of the most easily recognisable in the Ethiopian region. The combination of size, lack of scrobes and strong clypeal emargination immediately identifies the species. It does not appear to have any direct relatives and is not related to *agna* and *eminii*, two other species in which the scrobes are reduced. In both these species the petiole node is transverse and very different in shape from that of *rothschildi* and the clypeus is not emarginate, so there is no chance of confusing these species.

MATERIAL EXAMINED.

ETHIOPIA: Adamitullo (*K. M. Guichard*). KENYA: Mt Elgon (*G. Arnold*); Nairobi (*N. A. Weber*). GHANA: Northern Region, Tumu (*P. M. Room*).

Triglyphothrix sericea (Arnold) **stat. n.**

Tetramorium (*Triglyphothrix*) *hepburni* var. *sericeus* Arnold, 1926 : 277. Syntype workers, RHODESIA: Redbank, 3.xii.1917 (*G. Arnold*) (BMNH; NM, Bulawayo [examined].

Worker. TL 2·3–2·8, HL 0·58–0·72, HW 0·54–0·70, CI 93–97, SL 0·36–0·46, SI 65–67, PW 0·40–0·52, AL 0·64–0·80 (8 measured).

Antennal scrobes strongly developed, deep, with an acute dorsal margin and a marked median longitudinal carina. Propodeal spines triangular and acute. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely and densely irregularly rugulose or reticulate-rugulose. Base of first gastral tergite with a narrow, transverse band of punctate sculpture which is partially concealed by the overlying hairs and which is better developed in larger than in smaller specimens. Dorsal surfaces of head and body with numerous short branched hairs which are decumbent or are strongly curved basally and very closely applied to the surface from which they arise. Erect or suberect branched hairs are absent. Elongate, simple hairs are present only on the mouthparts. Colour uniform dark brown.

This is the only species in the Ethiopian region which completely lacks standing hairs of any description on the dorsal surfaces of the head and body, and this character alone renders it easily recognizable.

Arnold (1926) records that the nest of this species was constructed in loose sand.

MATERIAL EXAMINED.

RHODESIA: Victoria Falls (*G. Arnold*).

Triglyphothrix silvestrii Emery

Triglyphthorix silvestrii Emery, 1915*a* : 17, fig. 8. Syntype workers, ETHIOPIA: Eritrea, Nefasit, 30.viii.1914 (*F. Silvestri*) (MHN, Geneva; NM, Bulawayo) [examined].

Worker. TL 3·1, HL 0·72, HW 0·68, CI 94, SL 0·46, SI 68, PW 0·48, AL 0·74 (2 measured). Answering to the description of *brevispinosa*, from which it differs in the following respects.

1. Smaller, compare the above measurements with *brevispinosa*, HW minimum 0·74, PW minimum 0·50, CI minimum 98.
2. Node of petiole in dorsal view strongly anteroposteriorly compressed, very narrow and transverse, about 2·0 times broader than long. Anterior surface of node in dorsal view flat. In *brevispinosa* the node is not strongly compressed, is much less than 2·0 times broader than long and has the anterior surface convex in dorsal view.
3. Basal portion of first gastral tergite not punctate. In nearly all populations of *brevispinosa* punctures are present here, rarely reduced and even more rarely completely lacking.

Based only upon the type-series, the maintenance of *silvestrii* as a species separate from *brevispinosa* is open to question. The two are obviously very closely related indeed, but in the numerous series of *brevispinosa* examined none showed the highly compressed petiole possessed by the types of *silvestrii*. Nevertheless, I feel sure that further collections will gradually narrow the variation between the two forms and that *silvestrii* will eventually fall as a synonym of *brevispinosa*.

***Triglyphothrix talpa* sp. n.**

Holotype worker. TL 3·7, HL 0·88, HW 0·88, CI 100, SL 0·58, SI 66, PW 0·66, AL 0·98.

Antennal scrobes strongly developed, with an acute dorsal margin and a strong median longitudinal carina which extends back to the level of the posterior margin of the eye. Lower margin of scrobe weak behind the eye, more strongly developed in front. Median clypeal carina strongly developed, prominent; median cephalic carina distinct to level of posterior margin of antennal scrobe, behind this not more strongly developed than other sculpture. Propodeal spines short, stout and acute, the metapleural lobes low and rounded, not at all dentiform. Petiole in profile with the posterodorsal angle broadly rounded so that the dorsum curves evenly into the posterior face. Dorsal surfaces of head, alitrunk, petiole and postpetiole with a fine, close rugoreticulum. The basal third of the gaster with fine, spaced longitudinal costulae, punctures from which hairs arise and fine shagreening. Posterior to this the first and second components disappear so that only fine scattered punctures remain and posterior to this the gaster is smooth. Antennal scapes without elongate, erect hairs. Upper margins of antennal scrobes with a spaced row of elongate, simple hairs which are conspicuous and project freely above the general pilosity. Other long, simple hairs are present on the head, sparse except on the occiput where they are numerous. Long, simple hairs are present amongst the branched hairs on the alitrunk and pedicel but on the first gastral tergite the hairs are almost universally simple, with only one or two branched hairs (bifid or trifid) present. Legs with abundant short pilosity but without long, freely projecting hairs. Colour a uniform light yellow-brown.

Holotype worker, ZAIRE ('B. CONGO' on data label): 12 miles E. of Kikwit 6.viii.1957 (*E. S. Ross & R. E. Leech*) (CAS, San Francisco).

Related to *inezulae* and sharing most characters with that species, but differing in the lack of branched hairs on the first gastral tergite, slightly larger size and much lighter colour.

Triglyphothrix tenebrosa (Arnold) stat. n.

Tetramorium (*Triglyphothrix*) *constanciae* var. *tenebrosa* Arnold, 1926 : 275, fig. 79. Syntype workers, female, male, MOZAMBIQUE: Amatongas Forest, ii. 1917 and 12.ii.1917 (*G. Arnold*) (BMNH; NM, Bulawayo) [examined].

Worker. TL 3·6–3·8, HL 0·86–0·90, HW 0·80–0·84, CI 93–96, SL 0·58–0·60, SI 69–72, PW 0·60–0·64, AL 0·92–0·98 (6 measured).

Upper halves of antennal scrobes strongly developed, with an acute dorsal margin and a well-marked posterior margin. Lower portion of scrobe not strongly developed, usually containing a number of longitudinal rugae above and in front of the eye, which may be as well marked as the rather weak median longitudinal carina of the scrobe. In one or two specimens this carina is virtually indistinguishable from the other sculpturation. Promesonotum strongly convex, the latter portion of the mesonotum and the propodeum sloping steeply to the long, acute, propodeal spines. Head loosely and predominantly longitudinally rugulose, the alitrunk reticulate-rugose, more coarsely sculptured than the head. Petiole and postpetiole reticulate-rugulose dorsally. Mandibles striate, base of first gastral tergite with a faint transverse band of puncturation or shagreening, stronger in some individuals than in others. All dorsal surfaces of head and body with numerous branched hairs, those on the first gastral tergite trifid, rarely with a few quadrifid hairs also. Elongate, simple hairs present in a spaced row along the dorsal margin of the scrobes, and also a few scattered, simple hairs are present elsewhere on the dorsum of the head. Colour brown, the gaster usually a darker shade than the head and alitrunk.

Arnold originally described this species as a variety of *constanciae* but the two are in reality quite distinct. In *tenebrosa* elongate, simple hairs are present on the head and the hairs on the first gastral tergite are trifid, whereas in *constanciae* simple hairs are absent and the gastral hairs are quadrifid.

Arnold (1926) notes that this species was very common in the shady part of the (Amatongas) forest, nesting in the ground.

MATERIAL EXAMINED.

KENYA: Diani Beach (*N. L. H. Krauss*).

Triglyphothrix thoth sp. n.

Holotype worker. TL 2·4, HL 0·60, HW 0·54, CI 90, SL 0·40, SI 74, PW 0·42, AL 0·62.

Antennal scrobes developed and distinct, with an acute dorsal margin and a marked median longitudinal carina. Lower margin of scrobe behind eyes less strongly developed than upper margin. Alitrunk in profile short and broad, with short, triangular, acute propodeal spines. Entire dorsum of propodeum sloping strongly downwards from its junction with the mesonotum to the spines. Mandibles smooth with scattered pits, not longitudinally striate. Dorsal surfaces of head, alitrunk and pedicel finely and densely reticulate-rugulose, the first gastral tergite smooth and shining. Elongate, simple hairs absent, the entire body densely clothed with branched hairs, those on the first gastral tergite trifid. Colour uniform medium brown, the legs lighter, yellow-brown.

Paratype worker. TL 2·4, HL 0·58, HW 0·52, CI 90, SL 0·36, SI 69, PW 0·40, AL 0·56. Otherwise as holotype.

Holotype worker, SOUTH AFRICA: E. Cape Prov., Grahamstown, 22.ii.1969, Kloof off Southwell Rd (*W. L. Brown*) (MCZ, Cambridge).

Paratype. 1 worker, same data as holotype (BMNH).

This small species shows some affinities with *walshi* of the Oriental region but unlike that species it lacks simple hairs on the cephalic dorsum. Amongst its congeners in the Ethiopian region, *thoth* is the only species in its size-range which lacks long, simple hairs in a row on the upper scrobe margins. In most other very small species such hairs are present not only on the scrobe margins but also upon the leading edges of the antennal scapes.

Triglyphothrix trimeni Emery

Triglyphothrix trimeni Emery, 1895 : 40. Syntype worker, females, SOUTH AFRICA: Kimberley 1893 (*E. Simon*) (MCSN, Genoa).

Note. Three specimens in the Forel collection (MHN, Geneva) are labelled as cotypes (= syntypes) of this species. They are in no sense to be regarded as type-material as the locality given is E. Africa, Kibosho, Katona. These specimens serve as the basis for my interpretations of *trimeni* as they were apparently identified by Emery.

Worker. TL 2·2–2·3, HL 0·52–0·58, HW 0·46–0·50, CI 86–92, SL 0·32–0·34, SI 66–70, PW 0·38–0·40, AL 0·58–0·60 (3 measured).

Antennal scrobes present but shallow, the lower halves less strongly developed than the upper. Median longitudinal carina of scrobe weak, poorly differentiated, scarcely or not stronger than other rugulae occurring near the eye. Alitrunk short and broad, the anterior pronotal angles sharp in dorsal view, giving a square-shouldered appearance. Propodeal spines acute, the propodeum sloping downwards to the bases of the spines. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the transverse reticulation on the anterior half of the cephalic dorsum suppressed so that the rugulae are longitudinal. Basal portion of first gastral tergite with a band of punctate sculpturation, remainder of gaster unsculptured. Everywhere with numerous branched bifid or trifid hairs, the former apparently predominating. Dorsal surfaces of upper scrobe margins with a number of elongate simple hairs, which are longer than the neighbouring branched hairs. Colour dark brown.

This small, darkly coloured species bears a superficial resemblance to *furtiva* and *thoth*, but in both these species the base of the gaster is unsculptured or at most has only scattered minute punctures. Also *furtiva* has the lower portion of the scrobe well developed, with a strong median carina whilst *thoth* has the scrobes similar to *furtiva* but lacks elongate simple hairs on the upper scrobe margins. The species most closely related to *trimeni* appears to be *inezulae*; this is separable by the characters given in the key.

Triglyphothrix yarthiella sp. n.

Holotype worker. TL 3·4, HL 0·76, HW 0·72, CI 94, SL 0·54, SI 75, PW 0·54, AL 0·84.

Antennal scrobe with strongly developed dorsal margin but defined posteriorly and ventrally by a weak margin and a change in sculpture pattern. Median carina of scrobe weak, ending just behind the posterior margin of the eye. This median carina is situated low down in the scrobal area so that the upper compartment is much broader and more strongly developed than the lower, which is too small to accommodate the funiculus. Dorsal alitrunk evenly curved in profile, the propodeal spines short, quite stout. Metapleural lobes broadly triangular, acute apically. Node of petiole in dorsal view almost as long as broad, only very slightly broader than long. Dorsal surfaces of head, alitrunk and pedicel closely and distinctly fine reticulate-rugose. Upper compartment of scrobes reticulate-punctate. Base of first gastral tergite with a broad belt of coarse puncturation. All dorsal surfaces of head and body densely coated with branched hairs which on the first gastral tergite are predominantly quadrifid. Elongate, erect to suberect simple hairs are numerous on all dorsal surfaces of the head and body, projecting above the level of the branched hairs and easily visible in profile. Antennal scapes with a row of erect simple hairs on their leading (anterior) edges, the longest of which are subequal to the maximum width of the scape. Upper surfaces of dorsal margins of scrobe with a spaced row of long, simple hairs. Dorsal (outer) surfaces of middle and hind tibiae without elongate hairs. Colour uniform dark brown.

Paratype workers. As holotype, with measurements of TL 3·1–3·4, HL 0·70–0·78, HW 0·66–0·72, CI 90–95, SL 0·48–0·54, SI 73–79, PW 0·50–0·56, AL 0·76–0·86 (20 measured).

Holotype worker, ZAMBIA: Kapiri Mposhi, 1280 m, 10.ii.1958 (*E. S. Ross & R. E. Leech*) (CAS, San Francisco).

Paratypes. 34 workers with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge; MHN, Geneva; NM, Basle).

A medium-sized species related to *reptana* and *osiris* by the characters mentioned in the discussion of the species-groups. *T. yarthiella* is quickly separable from these two species as it possesses a band of coarse punctate sculpture at the base of the first gastral tergite, whereas in *reptana* and *osiris* this area is smooth and shining. Other species in which the gaster shows sculpture at the base are *inezulae* and its allies, but here elongate simple hairs are absent from the leading edges of the antennal scapes.

SPECIES OF THE ORIENTAL, INDO-AUSTRALIAN AND POLYNESIAN REGIONS

SYNONYMIC LIST OF SPECIES

***obesa*-group**
    antennata Mann **stat. n.**
    brevidentata Kutter
    chepocha **sp. n.**
    coonoorensis (Forel) **comb. n.**
    decamera Forel
    indosinensis (Wheeler) **comb. n.**
    lanuginosa (Mayr)
        striatidens (Emery) **syn. n.**
        striatidens st. *orissana* Forel **syn. n.**
        striatidens var. *australis* Forel **syn. n.**
        striatidens var. *felix* Forel **syn. n.**
        ceramensis Stitz **syn. n.**
        striatidens var. *flavescens* Wheeler **syn. n.**
        mauricei Donisthorpe **syn. n.**
        tricolor Donisthorpe **syn. n.**
    obesa (André)
    pacifica Mann
    rossi **sp. n.**
***walshi*-group**
    adpressa **sp. n.**
    fulviceps Emery
    katypa **sp. n.**
    kheperra **sp. n.**
    mayri Mann
    meshena **sp. n.**

nacta **sp. n.**
parvispina Emery
  parvispina var. *formosae* Forel **syn. n.**
pnyxis **sp. n.**
pulchella Mann
walshi Forel
  musculus Forel **syn. n.**
  walshi var. *spuria* Forel **syn. n.**

The species-groups

In the regions now under discussion 22 species are known, divisable for convenience into two equal-sized groups depending upon whether the gastral hairs are universally trifid (*walshi*-group) or not (*obesa*-group).

The *walshi*-group. The 11 species in this group, linked by their common factor of only having trifid hairs on the first gastral tergite and a stout, compact build, are roughly divisable into three complexes of more or less closely related forms. One complex contains the species *adpressa*, *fulviceps*, *mayri*, *meshena* and *pulchella* and is characterized by the complete lack of elongate simple hairs on the dorsum of the head and by the possession of distinct sculpturation on the basal portion of the first gastral tergite. The species *fulviceps*, *mayri* and *pulchella*, the first from New Guinea and the other two from the Solomon Islands, are very closely related and the remaining two, *adpressa* from Sulawesi and *meshena* from Malaya and Java, form a close species-pair.

The second complex contains *katypa*, *kheperra*, *nacta*, *parvispina* and *pnyxis*, and is characterized by the lack of basigastral sculpture and usually by the presence of long, simple hairs on the head, at least a row along the upper margins of the frontal carinae. Of these five, *parvispina* is known from Borneo, the Philippines and Taiwan but *katypa*, *nacta* and *pnyxis* are known only from their type-localities, respectively Philippines, Thailand and West Malaysia. The remaining species, *kheperra*, has a wide distribution in the Oriental and Indo-Australian regions and is capable of being spread by human commerce. It has been recorded twice to my knowledge in Great Britain, on both occasions imported with tropical plants or plant produce.

The final species, *walshi*, is unique in the south-east Asian *Triglyphothrix* fauna as the petiole node is strongly antero-posteriorly compressed and is transverse, much broader than long in dorsal view. It is possible that *walshi* originated in the Ethiopian region as its general build and petiole form appear to show relationship with the smaller species of the Ethiopian *inezulae*-group and to *thoth*, but no specimens matching *walshi* have been found in sub-Saharan Africa as yet. In distribution *walshi* is predominantly a species of the Indian subcontinent but also occurs sporadically elsewhere in the Oriental and Indo-Australian regions.

The *obesa*-group. In the group of 11 species the hairs of the head and body are not universally trifid, and in many species trifid hairs do not occur, their place being taken by bifid hairs. The predominant pilosity is of a mixture of simple and bifid hairs, usually with one or the other predominating but sometimes with approximately equal numbers of each. The general build of the body is less squat and stout than in the *walshi*-group and elongate simple hairs on the head and appendages are commonly encountered. The members of this species-group can be aggregated roughly into two complexes, the first of which contains *coonoorensis*, *decamera*, *lanuginosa*, *obesa* and *rossi*. These five species have long, erect or suberect hairs on the antennal scapes and the tibiae of the middle and hind legs, and also have elongate simple hairs on the dorsal head and alitrunk along with shorter branched hairs. The first gastral tergite usually has a mixture of simple and bifid hairs but in *coonoorensis* all are simple and in *obesa* some trifid hairs are present at least basally. All the species of this complex are more or less confined to the Indian subcontinent with the exception of *lanuginosa* which has a very wide range, being known throughout the Oriental, Indo-Australian and Polynesian regions and from many other localities both in and out of the tropics in both hemispheres. It is a highly successful tramp species spread by human commerce.

The species *antennata*, *brevidentata*, *chepocha*, *pacifica* and *vombis* form a complex characterized by the presence of numerous simple, long hairs on the head and alitrunk which are absent from the scapes and tibiae. Hairs of the first gastral tergite tend to be all simple, but in some bifid hairs are present. The distributions of these species are quite limited, with two Solomon Islands forms (*antennata*, *vombis*), one from the Fiji Islands (*pacifica*), and one each from Borneo and Java, *chepocha* and *brevidentata* respectively.

The final species included here, *indosinensis*, is known only from Vietnam and in many respects is the most peculiar member of the genus *Triglyphothrix* of all the regions at present under discussion. All hairs in this species are short and reclinate, predominantly trifid on head and alitrunk, universally simple on the dorsal portion of the first gastral tergite but trifid on the lateral parts of that sclerite. Coupled with this the antennal scapes and legs are very long and the antennal scrobes are absent. This peculiar species is included in this group for convenience; in many respects it is aberrant enough to merit a group on its own.

Only *antennata* and *brevidentata* of the *obesa*-group show any trace of sculpture on the first gastral tergite, the remaining species all have the sclerite smooth and shining.

KEY TO SPECIES

(Workers)

Note. The worker of *decamera* is not known, couplet 1 below refers to the queen.

1 Antennae with 10 segments, propodeum unarmed. (India) . . **decamera** (p. 347)

– Antennae with 12 segments, propodeum with a pair of spines or teeth . . . 2

2 Basal one-quarter to two-thirds of first gastral tergite distinctly sculptured with striation, puncturation or a combination of both; this area either markedly more strongly sculptured than the remainder of the sclerite or rarely the tergite sculptured throughout 3

– Basal portion of first gastral tergite not sculptured, the entire sclerite smooth and shining 10

3 Dorsal surface of head in profile with a number of elongate, simple hairs which are noticeably longer than the neighbouring simple or branched hairs and which project freely above the level of the shorter hairs 4

– Dorsal surface of head in profile without elongate, simple hairs. All hairs on cephalic dorsum branched and of approximately the same length . . . 6

4 Node of petiole in dorsal view strongly antero-posteriorly compressed, transverse, distinctly broader than long. Hairs on first gastral tergite universally and conspicuously branched, trifid. (India, Sri Lanka, China, Singapore, Philippines) ***walshi*** (part) (p. 358)

– Node of petiole in dorsal view not antero-posteriorly compressed, as long as or longer than broad. Hairs on first gastral tergite predominantly or entirely simple 5

5 Propodeum armed with a pair of spines which are at least as long as the metapleural lobes. Antennal scapes relatively longer, SI > 83. (Solomon Islands) ***antennata*** (p. 344)

– Propodeum with a pair of minute, obtuse tubercles which are much shorter than the metapleural lobes (Text-fig. 69). Antennal scapes relatively shorter, SI < 80. (Java) . . . . ***brevidentata*** (p. 345)

6 Basal portion of first gastral tergite longitudinally striate or costulate, sometimes with scattered punctures between the striae 7

– Basal portion of first gastral tergite punctate or reticulate-punctate, usually coarsely so; striation or costulation absent 8

7 Head bright yellow, contrasting strongly with the blackish brown alitrunk, pedicel and gaster. (New Guinea) . . . . ***fulviceps*** (p. 347)

– Entirety of head and body yellow, the alitrunk generally slightly darker in shade than the head and gaster. (Solomon Islands) . . . ***pulchella*** (p. 356)

8 Smaller species with narrower head and relatively longer antennal scapes, HW $< 0{\cdot}60$, CI ca 87–90, SI in range 77–81. Upper boundary of antennal scrobe without an acute, narrow, flange-like margin formed by the frontal carinae. Median longitudinal carina of scrobe very weak or absent, not more strongly developed than the surrounding sculpture. Colour yellow. (Solomon Islands) . . . . ***mayri*** (p. 352)

– Larger species with broader heads and relatively shorter antennal scapes, HW $> 0{\cdot}60$, CI ca 94–97, SI in range 61–68. Upper boundary of antennal scrobe with a distinct, acute, narrow flange-like margin formed by the frontal carinae. Median longitudinal carina of scrobe strongly developed, easily distinguished from the surrounding sculpture. Colour red-brown. 9

9 Propodeal spines long and narrow, much longer in profile than their basal width (Text-fig. 66). Trifid hairs on disc of first gastral tergite and on head short and closely applied to the surface from which they arise. (Sulawesi) ***adpressa*** (p. 344)

– Propodeal spines short, stout and broadly triangular, in profile about as long as their basal width (Text-fig. 67). Trifid hairs on disc of first gastral tergite and on head long and erect or suberect, not closely applied to the surface from which they arise. (West Malaysia, Java) . . . . . . ***meshena*** (p. 353)

10 Antennal scapes exceptionally long, SL $> 0{\cdot}75$, SI 100 or more; antennal scrobes completely absent. (Vietnam) . . . . ***indosinensis*** (p. 348)

– Antennal scapes much shorter, SL $< 0{\cdot}65$, SI < 90; antennal scrobes most commonly present, only rarely vestigial or absent 11

11 Node of petiole in dorsal view strongly antero-posteriorly compressed, transverse, distinctly broader than long. (India, Sri Lanka, China, Singapore, Philippines) ***walshi*** (part) (p. 358)

– Node of petiole in dorsal view not antero-posteriorly compressed, not transverse, generally as long as broad or very slightly broader than long 12

12 Hairs on first gastral tergite universally trifid and forming a dense pelt over the sclerite; simple or bifid hairs completely absent from the tergite . . . 13

– Hairs on first gastral tergite universally simple, or bifid, or a mixture of simple and branched hairs 17

13 With the petiole in profile the tergal portion of the node distinctly longer than high (Text-fig. 70) 14

– With the petiole in profile the tergal portion of the node at most as long as high, usually distinctly higher than long (Text-figs 64, 71) 15

14 Dorsal margin of frontal carinae forming the border of the scrobe with a spaced row of long, simple hairs which are very prominent. (Philippines) . ***katypa*** (p. 349)

– Dorsal margin of frontal carinae forming the border of the scrobe with abundant short, branched hairs but without a spaced row of long, simple hairs. (West Malaysia) . . . . ***pnyxis*** (p. 356)

15 Propodeal spines distinctly longer than the metapleural lobes. (India, Vietnam, Hong Kong, Philippines, Borneo, Malaya, Java, Sumba, Sulawesi; introduced in temperate zone with plant products) . . . . . . ***kheperra*** (p. 349)

– Propodeal spines shorter than metapleural lobes, at most the spines almost as long as the lobes 16

16 Larger species, with relatively shorter antennal scapes, $\mathrm{HW} > 0{\cdot}70$, $\mathrm{SI} < 70$. (Thailand) . . . . ***nacta*** (p. 353)

– Smaller species with relatively longer antennal scapes, $\mathrm{HW} < 0{\cdot}65$, $\mathrm{SI} > 70$. (Borneo, Philippines, Taiwan) . . . . ***parvispina*** (p. 355)

17 Dorsal (outer) surface of hind tibiae viewed from in front or behind with numerous long hairs of varying length, the longest of them at least subequal to the maximum tibial width; these hairs never forming a close mat above the tibial surface (Text-fig. 38) 18

– Dorsal (outer) surface of hind tibiae viewed from in front or behind with abundant short, curved hairs of approximately uniform length which are much shorter than the maximum tibial width, usually less than half the tibial width; these hairs characteristically forming a close mat above the tibial surface (Text-fig. 39) 20

18 First gastral tergite with all hairs simple. (India) . . ***coonoorensis*** (p. 346)

– First gastral tergite with at least a few bifid or trifid hairs present . . . 19

19 Mandibles smooth with scattered punctures, not longitudinally striate. HW in range 0·76–0·82. First gastral tergite with trifid hairs on basal half. (India, Burma) . . . . ***obesa*** (p. 354)

– Mandibles longitudinally striate, the striation sometimes indistinct or absent in small specimens. HW in range 0·52–0·70. First gastral tergite basally with a mixture of simple and bifid hairs, trifid hairs usually completely absent. (Throughout Oriental and Indo-Australian regions; cosmopolitan tramp species) ***lanuginosa*** (p. 350)

20 Dorsal surfaces of both petiole and postpetiole reticulate-rugose, the two about equally densely sculptured 21

– Dorsum of postpetiole mostly smooth and shining with only vestigial sculpture in places, distinctly less densely sculptured than the petiole dorsum. (Fiji Islands) ***pacifica*** (p. 255)

21 First gastral tergite with hairs universally simple or at most with only 1–2 bifid hairs. Antennal scrobes strongly developed, with an acute dorsal margin . . 22

– First gastral tergite with a distinct mixture of simple and bifid hairs. Antennal scrobes vestigial, without an acute dorsal margin. (India) . . ***rossi*** (p. 357)

22 Node of petiole in profile massive, its outline almost square, and with well developed antero- and posterodorsal angles (Text-fig. 72). Larger species with HW in range 0·72–0·76, SL in range 0·56–0·58. (Borneo) . . . ***chepocha*** (p. 345)

– Node of petiole in profile relatively low and convex above, its outline not square, and with the dorsal surface rounding into the posterior face so that there is no defined posteroventral angle (Text-fig. 73). Smaller species with HW in range 0·64–0·66, SL in range 0·46–0·50. (Solomon Islands) . . . ***vombis*** (p. 358)

TREATMENT BY SPECIES

Triglyphothrix adpressa sp. n.

(Text-fig. 66)

Holotype worker. TL 3·1, HL 0·72, HW 0·70, CI 97, SL 0·44, SI 63, PW 0·52, AL 0·80.

Sides of head convex, occipital margin shallowly concave in full-face view. Antennal scrobes strongly developed, with a distinct dorsal margin and a marked median longitudinal carina which is well differentiated from the surrounding sculpture and which reaches back beyond the posterior margin of the eye. Propodeal spines long and acute, quite narrow, distinctly longer than their basal width in profile. Metapleural lobes strongly developed, acute, feebly upcurved (Text-fig. 66). Pedicel in dorsal view with the postpetiole very slightly broader than the petiole (about 0·02 difference) and the petiole node slightly broader than long (about 0·04 difference). Mandibles striate; head, alitrunk, petiole and postpetiole densely punctate with scattered rugulae, base of first gastral tergite densely punctate. Pilosity on dorsum of body entirely of short trifid hairs of approximately equal length, which are closely adpressed on the head and gaster; long simple hairs completely absent from dorsal surfaces and from appendages. Hairs on scapes and tibiae short, distinctly less than half the maximum width of the surfaces on which they arise.

Paratype workers. TL 2·8–3·1, HL 0·70–0·74, HW 0·66–0·72, CI 94–97, SL 0·42–0·44, SI 61–64, PW 0·50–0·54, AL 0·74–0·80 (3 measured). As holotype.

Holotype worker, SULAWESI ('N. Celebes' on label): SW. slope Mt Klabat, 400–600 m, 13–19.vi.1972, rain forest (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 3 workers with same data as holotype (MCZ, Cambridge, BMNH).

This species is very closely related to *meshena* and I would not be surprised if further collections from Indonesia were to lead to the conclusion that the two are inseparable. For the present, however, I consider that they should be separated on the grounds that in *adpressa* the cephalic and gastral hairs are very short and strongly adpressed, the propodeal spines are long, narrow and acute and the metapleural lobes are narrower and upcurved. In *meshena* the cephalic and gastral hairs are longer and are erect or suberect, the propodeal spines are short and broad and the metapleural lobes are broader and scarcely or not upcurved (compare Text-figs 66 and 67). Other closely related species include *parvispina* and the widespread *kheperra*, but in both these species the basal portion of the first gastral tergite is unsculptured.

Triglyphothrix antennata Mann stat. n.

Triglyphothrix fulviceps subsp. *antennata* Mann, 1919 : 350, fig. 30. Syntype workers, SOLOMON ISLANDS: Santa Cruz, Graciosa Bay, 1916 (*W. M. Mann*) (MCZ, Cambridge) [examined].

Worker. TL 3·0–3·2, HL 0·66–0·68, HW 0·56–0·60, CI 85–89, SL 0·50–0·52, SI 87–89, PW 0·46, AL 0·76–0·78 (2 measured).

Antennal scrobes poorly developed, with a weak dorsal border which is only differentiated to about the level of the posterior margin of the eye when viewed in profile. Behind the level of the eye it tends to merge into the surrounding sculpturation, which is moderately strongly developed on the sides of the head behind the eyes. Median longitudinal carina of scrobe absent or so weakly developed that it is indistinguishable from other longitudinal rugulae above the eye. Antennal scapes long, the SI of 87–89 being approached only by *mayri* and *pacifica* which have a maximum SI of about 80. Mandibles striate, the dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, the basal portion of first gastral tergite strongly punctate. Pilosity everywhere predominantly of fine, dense, simple hairs which are of varying length on the head and dorsal alitrunk. On the scapes and legs the hairs are shorter and more or less uniform in length; long, erect projecting hairs are absent. Head and gaster yellow-brown in colour, the alitrunk and pedicel darker.

Along with its allies *brevidenata*, *pacifica* and *vombis* this species shows a marked tendency towards the loss of branched hairs. This tendency is obviously better developed in *antennata* than in the other species as here branched hairs appear to be almost completely absent whilst at least a few are retained in the related species. Despite this *antennata* is still very densely hairy, the individual hairs fine and generally curved. Identification of the species should be relatively simple by the use of the combination of characters given in the diagnosis above.

Triglyphothrix brevidentata Kutter

(Text-fig. 69)

Triglyphothrix brevidentata Kutter, 1932 : 208, figs. Holotype worker, JAVA: Sarangan, Lawoe-Geb. 1927 (*H. Overbeck*) (Dresden Museum).

Worker. TL 2·6–2·7, HL 0·62–0·64, HW 0·54–0·58, CI 88–91, SL 0·40–0·42, SI 72–75, PW 0·44–0·46, AL 0·68–0·70 (4 measured).

Antennal scrobes developed but weakly so, the median longitudinal carina scarcely more strongly developed than the surrounding sculpture. Propodeal spines reduced to a pair of minute, obtusely-rounded tubercles above the broad, triangular, acute metapleural lobes. Mandibles striate. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugulose. Extreme basal portion of first gastral tergite sparsely punctate, the spaces between punctures usually finely shagreened; remainder of gaster smooth and shining. Branched hairs sparse on head and alitrunk, more numerous on petiole and postpetiole, apparently absent on gaster. Long, simple hairs numerous on dorsal surfaces of head and body but scapes and tibiae with only short, curved hairs. Colour brown to reddish brown, the appendages lighter.

Of the species known from the regions at present under consideration only two have the propodeal armament strongly reduced, *brevidentata* and *parvispina*, but in the latter the propodeal spines are still present as small, acute teeth, whereas in the former only low, rounded tubercles are present. Also, *parvispina* has abundant branched hairs upon the gaster whilst in *brevidentata* all gastral hairs appear to be simple. Finally, the base of the gaster is sculptured in *brevidentata* and is not in *parvispina*.

Within the obesa-group *brevidentata* appears closest related to *antennata* but the latter has strongly developed propodeal spines and relatively much longer antennal scapes.

Apparently *brevidentata* is only known from Java, where it has been collected twice in my knowledge, besides the type-collection. Both these collections were made at Tjibodas by Dammerman, in 1921 and 1922.

Triglyphothrix chepocha **sp. n.**

(Text-fig. 72)

Holotype worker. TL 3·2, HL 0·76, HW 0·72, CI 95, SL 0·56, SI 77, PW 0·58, AL 0·94.

Antennal scrobes shallow, with very feebly defined posterior and ventral margins. Dorsal margin of scrobe more strongly defined and acute, but not a distinct flange or rim as is seen in most species of this group, rather it is an uneven line where the sculpture of the cephalic dorsum terminates at the frontal carinae. Median carina of scrobe absent or not differentiated from the surrounding sculpture. Propodeal spines long and acute, longer than the large, triangular, upcurved metapleural lobes. Node of petiole in profile blocky and massive, its outline almost square, with strongly developed antero- and postero-dorsal angles. In dorsal view the node is about as broad as long, much broader behind than in front and narrowly rounded anteriorly. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely and quite densely reticulate-rugulose. All dorsal surfaces of head and body with numerous long, simple hairs, universally simple on the first gastral tergite. Elsewhere numerous short bifid or trifid hairs are present amongst the more conspicuous long simple hairs. Long hairs such as are present on the head and alitrunk are absent from the legs and antennae where much shorter simple hairs are present with a few bifid individuals. Colour dark red-brown, the appendages lighter, yellow-brown.

Paratype workers. As holotype but one or two specimens with a single bifid hair on the first gastral tergite. TL 3·0–3·4, HL 0·74–0·80, HW 0·72–0·76, CI 95–97, SL 0·56–0·58, SI 76–78, PW 0·56–0·60, AL 0·92–0·98 (9 measured).

Holotype worker, BORNEO: Kiduk Arok, Trus Madi Massif, 1500 m, Cambridge N. Borneo Exped. no 75 (*P. W. Bryant*) (MCZ, Cambridge).

Paratypes. 11 workers with same data as holotype (BMNH; MCZ, Cambridge).

T. chepocha appears to be most closely related to *vombis* of the Solomon Islands, but this species is smaller and has a differently shaped petiole node, details of which are given in the key.

Triglyphothrix coonoorensis (Forel) **comb. n.**

(Text-fig. 65)

Tetramorium coonoorense Forel, 1902*a* : 237. Syntype workers, female, INDIA: Coonoor (*Wroughton*) (MHN, Geneva) [examined].

Worker. TL 2·7–2·8, HL 0·64–0·66, HW 0·56–0·58, CI 87–89, SL 0·44–0·46, SI 77–79, PW 0·44–0·46, AL 0·72–0·74 (4 measured).

Antennal scrobes poorly developed and shallow, the dorsal margin formed by the termination of the cephalic rugosity and not by a projecting, flange-like edge. Median longitudinal carina of scrobe not developed. Dorsal outline of alitrunk regularly convex, the propodeal spines long and quite narrow, only slightly tapered from base to apex. Petiole node in profile low, paniform, longer than high, the anterior peduncle of the petiole meeting the node so that its dorsal surface is continuous with the anterior face of the node and the ventral surface meets the ventral surface of the node through an obtuse angle. Dorsum of head, alitrunk and pedicel reticulate-rugulose, the gaster unsculptured. Sculpture within the scrobe basically a continuation of the rugulation present on the remainder of the head but weaker and with a tendency for it to be replaced by dense puncturation, especially in the upper half of the scrobe. Long, simple hairs present on all dorsal surfaces and on appendages. Branched, bifid hairs sparse everywhere, best developed on dorsal alitrunk and sides of petiole, completely absent from first gastral tergite. Colour light brown to mid-brown, the head usually distinctly darker than the alitrunk.

Closely related to *obesa* and *lanuginosa* but separated from them by the absence of branched hairs from the first gastral tergite; such hairs are numerous or abundant in the related species.

Apart from the type-series of three workers and a female the only other material of this species examined comes from a short series collected by Bingham, presumably from India but without further data, and the series noted below.

MATERIAL EXAMINED.

INDIA: Nilgiri, Madras, Halical nr Coonoor (*Besuchet, Löbl, Mussard*).

Triglyphothrix decamera Forel

Triglyphothrix decamera Forel, 1902*a* : 240. Holotype female, INDIA: Kanara (*Aitken*) (MHN, Geneva) [examined].

Holotype female. TL 2·9, HL 0·60, HW 0·54, CI 90, SL 0·34, SI 63, PW 0·56, AL 0·82.
Although only known from the type-collection of a single female this species should be easily recognised if found again as the antennae have only 10 segments and the propodeum is completely unarmed, without trace of teeth. The petiole is distinctly narrower than the postpetiole in dorsal view, their respective widths ca 0·20, 0·30. Pilosity everywhere is long, erect, and consists of a mixture of simple and bifid hairs, with the former tending to predominate. Head, alitrunk and pedicel covered with fine, superficial rugosity, the gaster shining, unsculptured.

The form of the pilosity and the presence of long, erect simple hairs projecting from the tibiae and antennal scapes relates *decamera* to *obesa* and its allies, but in all other species of the *obesa*-group the female has 12-segmented antennae as in the worker and the propodeum is armed with spines or teeth. The possibility that *decamera* is a temporary or permanent social parasite should not be overlooked, and if this is the case then it is also possible that the workers (if any) do not share the singular characters of the female, as Brown (1964) has pointed out in his study of *Rhoptromyrmex*, where the queens are quite different from the workers of the same species and are assumed to be social parasites.

Triglyphothrix fulviceps Emery

(Text-fig. 62)

Triglyphothrix fulviceps Emery 1897 : 588. Syntype workers, NEW GUINEA: Friedrich-Welhelmshafen (*L. Biró*) (MCSN, Genoa) [examined].

Note. A number of specimens in MHN, Geneva are labelled as cotypes (= syntypes). These were collected in New Guinea by Biró but in 1898–99 and are thus not types. The localities of these specimens are Huon Golf, Sattelberg and Astrolabe Bai, Stephansort.

Worker. TL 2·5–3·0, HL 0·60–0·70, HW 0·52–0·64, CI 84–91, SL 0·34–0·46, SI 63–72, PW 0·42–0·52, AL 0·62–0·80 (15 measured).
Antennal scrobes distinct, with a weakly developed median longitudinal carina which in some specimens runs the length of the scrobe. Propodeal spines long and acute, varying in length between individuals but always much longer than the metapleural lobes which are somewhat reduced and rounded. Node of petiole low in profile, its anterior face very short, merging into the peduncle. In dorsal view the node broader than long. Dorsal surfaces of head, alitrunk and pedicel closely and very finely and densely reticulate-rugose; mandibles striate. Basal half or more of first gastral tergite strongly longitudinally striate, the spaces between the striae often with punctures, especially basally. First gastral sternite sculptured.

Entirety of head, body and appendages covered with a dense mat of short, branched hairs, apparently mixed trifid-quadrifid. Simple long hairs absent. Alitrunk, pedicel and gaster light to very dark brown, the head bright yellow, contrasting strongly to the remainder of the body.

This very distinctive species is apparently confined to New Guinea but two related species, *pulchella* and *mayri*, are known from the Solomon Islands. A third species, and the one most closely resembling *fulviceps*, is *pulcherrima* from Uganda, but the apparent similarities in colour, sculpture and body form may be due to convergence as the petiole node is very differently constructed in the Ugandan species, the node being high and narrow in profile with a deep anterior face (compare Text-figs 62 and 59).

MATERIAL EXAMINED.

NEW GUINEA: Huon Peninsula, Lower Busu R. (*E. O. Wilson*); Huon Peninsula, Ngandus (*E. O. Wilson*); Nadzab (*E. O. Wilson*); Lae, Didiman Ck. (*E. O. Wilson*); Bunbok Valley, Boana (*E. O. Wilson*); Lae (*E. Hardy*); Cyclops Mts, Mt Lina (*L. E. Cheesman*); Wau N. on Bulolo Rd (*S. Peck*); W. Highlands, Baiyer R. (*S. Peck*).

Triglyphothrix indosinensis (Wheeler) **comb. n.**

Tetramorium indosinense Wheeler, 1927 : 97, fig. 6. Syntype workers, VIETNAM: Klinai Tao, 2.viii.1925 (*F. Silvestri*) (MCZ, Cambridge) [examined].

Note. In the original description the type-locality is given as Hanoi, but the specimens determined and labelled as types by Wheeler give the locality as Klinai Tao. As these specimens fit the original description perfectly and have been labelled as types by Wheeler himself it is assumed that the locality of Hanoi is an error.

Worker. TL 3·4–3·6, HL 0·88–0·92, HW 0·78–0·80, CI 87–89, SL 0·80–0·82, SI 100–103, PW 0·50–0·52, AL 0·94–0·96 (3 measured).

Antennal scrobes absent, frontal carinae reduced, ending at the level of the anterior margin of the eye. Eyes small, maximum diameter ca 0·14, very slightly greater than the maximum width of the scape. Antennal scapes exceptionally long, the longest recorded in the genus to date. Promesonotal dorsum evenly convex, metanotal groove faintly indicated in profile. Propodeal spines elongate and acute. Legs very long, maximum length of hind femur ca 0·88. Petiole in profile with a long anterior peduncle and a high, roughly rectangular node. In dorsal view the node is compressed from side to side, slightly longer than broad and broader behind than in front. Mandibles longitudinally striate-rugulose. Dorsum of head predominantly finely longitudinally rugulose, the rugulae diverging posteriorly and with a few faint cross-meshes which are distinctly weaker than the longitudinal component. Dorsal alitrunk with pronotum reticulate-rugulose, the sculpture becoming much weaker posteriorly. Petiole with vestiges of rugulation but the postpetiole almost completely smooth. Gaster unsculptured. All surfaces of head and body with numerous fine short hairs which are reclinate or closely adpressed to the surface and which are predominantly trifid, except on the dorsum of the first gastral tergite where the majority of hairs are simple. Elongate, erect, simple hairs completely absent. Colour dull yellow-brown.

The combination of extremely long antennal scapes, lack of scrobes and very long legs makes this species unmistakable. At present it cannot be assigned to any definite species-group as it shows very few similarities with any other known species.

Triglyphothrix katypa sp. n.

Holotype worker. TL 2·7, HL 0·64, HW 0·58, CI 90, SL 0·44, SI 77, PW 0·44, AL 0·74.

Antennal scrobes with a sharp dorsal margin, less strongly defined posteriorly and ventrally, primarily demarcated ventrally by a change in sculpture from a rugoreticulum outside the scrobe to reticulate-punctate inside. Median carina of scrobe distinct to level of posterior margin of eye. Dorsal alitrunk evenly convex, the propodeum with a pair of short, acute spines which are shorter than the long, broadly triangular metapleural lobes. Petiole in profile with the tergal portion of the node distinctly longer than high, in dorsal view the node slightly broader than long, broadest at about its midlength. All dorsal surfaces of head, alitrunk, petiole and postpetiole finely, closely reticulate-rugulose. Mandibles longitudinally striate; gaster smooth and shining. All dorsal surfaces of head and body with numerous trifid hairs, those on the first gastral tergite universally so. Dorsum of head with numerous elongate, simple hairs and especially with a spaced row of long, simple, quite stout hairs along the dorsal edge of the frontal carinae where they form the upper borders of the scrobes. A few simple long hairs are also present on the dorsal alitrunk but are absent from the first gastral tergite, antennae and legs. Colour light red-brown, the appendages and gaster yellow-brown.

Paratypes. As holotype, with dimensions TL 2·6–2·7, HL 0·60–0·64, HW 0·54–0·58, CI 90–93, SL 0·42–0·44, SI 73–77, PW 0·42–0·46, AL 0·70–0·74 (4 measured).

Holotype worker, PHILIPPINES: Dumaguete, Lake, 30.iv.1931 (*J. W. Chapman*) (MCZ, Cambridge).

Paratypes. 4 workers with same data as holotype (BMNH; MCZ, Cambridge)

This small species is most closely related to *pnyxis* of West Malaysia but is separable by the lack of elongate simple hairs from the upper scrobe margins in *pnyxis*, distinct in *katypa*.

Several more series of this species are present in the Chapman collection at MCZ, Cambridge, but they are all dirty and in rather poor condition; they will require cleaning and remounting before they can be of any value to systematics.

Triglyphothrix kheperra sp. n.

(Text-fig. 71)

Holotype worker. TL 2·6, HL 0·66, HW 0·64, CI 97, SL 0·44, SI 69, PW 0·46, AL 0·68.

Antennal scrobes strongly developed, with an acute dorsal margin and a distinct median longitudinal carina; the lower margin of the scrobe well defined behind the eye. Propodeal spines acute, longer than the metapleural lobes (which in many specimens tend to be low, broad and rounded). The petiole node in dorsal view is slightly broader than long (ca 0·04–0·06 difference) but in profile it is high and relatively narrow, with front and rear faces roughly parallel. Dorsal surfaces of head, alitrunk and pedicel finely and closely reticulate-rugose, the gaster unsculptured, smooth and shining. All dorsal surfaces of head and body coated with abundant trifid hairs, the cephalic dorsum also with a few longer, simple hairs on the upper margins of the antennal scrobes. (In some specimens, rarely, one or two long, simple hairs are present elsewhere on the dorsum of the head.) Hairs on outer surfaces of middle and hind tibiae short, of equal length, distinctly less than the maximum tibial width. Colour uniform brown, varying in shade from light to mid-brown in the material available.

Paratypes. As holotype, with a size-range TL 2·5–2·8, HL 0·56–0·70, HW 0·50–0·66, CI 92–97, SL 0·34–0·46, SI 67–72, PW 0·40–0·52, AL 0·62–0·76 (10 measured).

Holotype worker, JAVA: Bogor, 21.x.1973 (*B. Bolton*) (BMNH).

Paratypes. 8 workers with same data as holotype; 5 workers as holotype but 24.x.73; 1 worker 19.x.1973, and 6 workers 29.x.73. (BMNH; MCZ, Cambridge; MHN, Geneva.)

This species, although previously undescribed, is widespread in the Oriental and Indo-Australian regions and is capable of acting as a tramp species in human commerce dealing with fresh plants and their products. Specimens have been intercepted at least twice in Britain, once from York (1928) in a consignment of illipic nuts from Borneo (recorded by Donisthorpe, 1933 as *lanuginosa*), and more recently in Kew Gardens, London (1974) amongst the roots of a plant imported from Assam. No doubt the species has been introduced on other occasions but has gone unnoticed or has been assumed to be *lanuginosa* (= *striatidens*), the most common tramp-species in this genus both in Britain and in other temperate-zone countries.

The closest relatives of *kheperra* include *adpressa* and *meshena*, which are easily separated as they have the first gastral tergite sculptured basally, and *parvispina*. This last-named species is close to *kheperra* but has much shorter propodeal spines.

MATERIAL EXAMINED.

INDIA: Assam (intercepted at Kew Gdns, England). VIETNAM: Van Phu (*F. Silvestri*). HONG KONG (*R. H. Lefevre*). PHILIPPINES: Mt Magading (*C. F. Baker*). BORNEO: Sarawak (*R. Thaxter*); Pontianak (*H. Britten*) (intercepted at York, England). SUMBA: Kananggar (*Dammerman*). PRINSEN I. (*Dammerman*). SULAWESI: Balampesoang For. (*W. L. Brown*).

Triglyphothrix lanuginosa (Mayr)

(Text-fig. 63)

Tetramorium lanuginosum Mayr, 1870 : 972, 976. Holotype worker, JAVA: Batavia (= Djakarta) (NM, Vienna) [examined].

Tetramorium obesum race *striatidens* Emery, 1889*b* : 501. Syntype workers, BURMA: Bhamó, vii. 1886 (*L. Fea*) (MHN, Geneva) [examined]. **Syn. n.**

Triglyphothrix lanuginosa (Mayr) Emery, 1891 : 4 (implied in footnote 2).

Triglyphothrix obesus race *striatidens* (Emery); Emery, 1891 : 4.

Triglyphothrix striatidens var. *laevidens* Forel, 1900 : 284. Syntype workers, MEXICO (MHN, Geneva) [examined]. **Syn. n.**

Triglyphothrix striatidens (Emery); Forel, 1902*b* : 704. [Raised to species.]

Triglyphothrix striatidens st. *orissana* Forel, 1902*a* : 239. Syntype workers, INDIA: Orissa XLIV/17b (*Taylor*) (MHN, Geneva) [examined]. **Syn. n.**

Triglyphothrix striatidens var. *australis* Forel, 1902*c* : 449. Syntype workers, females, AUSTRALIA: Queensland, Mackay (*Turner*) (MHN, Geneva; MCZ, Cambridge) [examined]. **Syn. n.**

Triglyphothrix striatidens var. *felix* Forel, 1912*b* : 160. Syntype workers, SEYCHELLE ISLANDS: Félicité, Silhouette, Mare aux Cochons, 1908 (*H. Scott*) (MHN, Geneva; BMNH) [examined]. **Syn. n.**

Triglyphothrix ceramensis Stitz, 1912 : 506. Holotype worker, SERAM (*Tauern*) (location of holotype not known). **Syn. n.**

Triglyphothrix striatidens var. *flavescens* Wheeler, 1929 : 55. Syntype workers, SINGAPORE: Johore, 11.ii.25 (*F. Silvestri*) (MCZ, Cambridge) [examined]. **Syn. n.**

Triglyphothrix mauricei Donisthorpe, 1946*a* : 778. Holotype and paratype worker, MAURITIUS: Rose Hill, 1942 (*R. Mamet*) (BMNH) [examined]. **Syn. n.**

Triglyphothrix tricolor Donisthorpe, 1948 : 136. Paratype workers, females, NEW GUINEA: Maffin Bay, 17 and 20.vi 1944 (*E. S. Ross*) (BMNH; CAS, San Francisco) [examined]. **Syn. n.**

Worker. TL 2·2–3·0, HL 0·56–0·72, HW 0·52–0·70, CI 92–97, SL 0·36–0·50, SI 68–75, PW 0·40–0·50, AL 0·58–0·80 (25 measured).

Antennal scrobes well developed with a sharply marked dorsal margin and usually with a defined median longitudinal carina, although in some specimens this may be rather reduced. In all material examined the scrobe ends well behind the posterior margin of the eye. Propodeal spines long and acute, longer than the metapleural lobes, and are usually feebly upcurved along their length. Metapleural lobes usually somewhat upcurved and acute. Node of petiole in profile with the dorsal surface curving into the posterior face so that the two are not separated by an angle but by a curvature which is much less acute than the angle separating anterior and dorsal surfaces. In extreme cases the dorsal and posterior faces are united in a single convexity (Text-fig. 63). Petiole more massively built than postpetiole. Mandibles striate except in some small individuals where it may be partially effaced or absent. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely reticulate-rugose. On the head there is a tendency for the transverse rugulae to break down on the anterior portion, leaving this area longitudinally rugose, and on the postpetiole the sculpture may be partially or totally effaced, usually in smaller specimens. First gastral tergite smooth and shining. All dorsal surfaces of head and body with abundant hairs, predominantly a mixture of simple and bifid but sometimes also with a few trifid hairs. On the first gastral tergite trifid hairs are nearly always absent. Numerous elongate, simple hairs present. Leading edges of antennal scapes and outer margins of middle and hind tibiae with numerous simple hairs of varying length, the longest of which are at least as long as the maximum width of the appendage from which they arise. Colour brown, varying in shade from light to dark, often with alitrunk and gaster of different shades.

An accomplished tramp-species on a worldwide scale, *lanuginosa* (better known by its junior synonym *striatidens*), is known or has been reported from all major and a great number of minor land masses on the earth's surface. Wilson & Taylor (1967) state that the species (recorded as *striatidens*) 'is probably native to tropical Asia', and I concur with this as the most closely related species to *lanuginosa* (*coonoorensis* and *obesa*) are known only from India and Burma. In the tropics the species survives outdoors but known collections of *lanuginosa* from the temperate zones have all been made in botanical or zoological gardens where the ants have most probably been imported with tropical plants or animal foodstuffs.

MATERIAL EXAMINED.

INDIA: Barrakpore (*Rothney*); Calicut (*A. B. Soans*); Maharashtra, Edalabad (*E. S. Ross & D. Q. Cavagnaro*); Assam, Jorhat (*A. C. Cole*); Assam, Garo Hills, Siju Cave; Kerala State, Kannoth (*A. B. Soans & W. L. Brown*); Calcutta (ex coll. F. Smith); no. loc. (*Wroughton*); Poona (*Wroughton*). NEPAL: Amlekhganj (*E. I. Coher*). SRI LANKA: Pollonaruwa (*K. L. A. Perera*). BURMA: Bhamo (*Bingham*). PHILIPPINES: Mindoro, San Jose (*E. S. Ross*); Luzon, Mt Makiling (*K. Dumont & R. Morse*); Dumaguette (*J. W. Chapman*); Iloilo (*S. Amaguin*); Negros I., Bago (*F. del Rosario*); Davao (*A. Reyes*); Dumaguete (*D. Empeso*); Dumaguete (*F. del Rosario*); Horns of Negros (*J. W. Chapman*). SOLOMON IS.: Guadalcanal (*P. Greenslade*); New Georgia (*P. Greenslade*). WEST MALAYSIA: Alor Star (*G. H.

Lowe); Sg. Patani (*G. H. Lowe*); Kuala Lumpur (*K. W. Ng*). BORNEO: Kuching (*J. Hewitt*). JAVA: Batavia (= Jakarta); Semarang. FLORES: Nangagete (*W. L. Brown*). SUMBA: Laora (*Dammerman*); Kambera (*Dammerman*). AUSTRALIA: Queensland, Townsville (*Dodd*); Cape York, Silver Plains (*Darlington*); N. Terr., Howard Springs (*Brown*); N. Terr., Mt Bundy Rd (*Brown*); Lankelly Ck. (*Darlington*); Mackay (*R. E. Turner*); N. Terr. (*G. F. Hill*). MARIANAS I.: Guam, Pt Oca (*G. E. Bohart & J. L. Gressitt*); Pati Point (*H. S. Dybas*); Amantes Point (*H. S. Dybas*). CAROLINE IS.: Truk I. (*Yasu et Yoshi*); Yap I., S. Ramung I. (*R. J. Goss*). WALLIS IS.: Nuku Tapu I; Nuku Hifala I; Uvea; Nukuione I. (*G. Hunt*). SAMOA: Upolu, Lauli (*T. E. Woodward*). CHRISTMAN I. (no data). ALDABRA: South I. (*B. Cogan & A. Hutson*). LEBANON: Antilias Stream (*Christiansen*). ENGLAND: London, Kew Gdns (*Donisthorpe*); Birmingham, Bot. Gdns (*Bibikoff*); Birmingham, Dudley Zoo (*A. L. Mills*). CLIPPERTON I. (*C. F. Harbison*). GERMANY (WEST): Hamburg, imported from Mexico in orchids (ex coll. Forel). JAPAN: Ogasahara, Chichi-jima (*M. Tanaka*).

Other localities include: Seychelle Is., Seram, Singapore, New Guinea, Mauritius, Mexico—see type-data; U.S.A.: south-eastern United States N. to Carolinas (Creighton, 1950); Tunisia (Emery, 1891); Barbados, Mexico (Kempf, 1972).

Triglyphothrix mayri Mann

Triglyphothrix mayri Mann, 1919 : 351. Syntype workers, SOLOMON ISLANDS: San Cristoval, Star Harbor (*W. M. Mann*) (MCZ, Cambridge) [examined].

Worker. TL 2·5–2·8, HL 0·58–0·62, HW 0·52–0·54, CI 87–90, SL 0·42–0·44, SI 77–81, PW 0·42–0·44, AL 0·68–0·70 (5 measured).

Antennal scrobe weakly developed, its upper margin poorly defined, not bounded by a narrow flange-like margin but limited by the sculpturation of the cephalic dorsum. Median longitudinal carina of scrobe poorly developed or indistinguishable from other scrobal sculpture. Sides of head more or less straight in full-face view, only extremely feebly convex; eyes prominent. Propodeal spines about as long as the metapleural lobes. Petiole in dorsal view slightly broader than long, in profile the anterior face confluent with the peduncle. Mandibles mostly smooth, with some very faint, almost effaced striation and a few scattered punctures. Dorsal surfaces of head, alitrunk and pedicel finely and densely reticulate-rugose. Basal half or more of first gastral tergite coarsely punctate. All surfaces of head, body and appendages densely coated with short, branched (trifid) hairs of approximately the same length. Long, simple hairs absent from legs, scapes and body behind the mouthparts. Colour uniform pale yellow.

Apparently known only from the type-collection, this species is one of four endemic species known to the present only from the Solomon Islands. Two of these species, *antennata* and *vombis*, belong to the *obesa*-group and have numerous simple long hairs projecting from the cephalic dorsum. *T. mayri*, along with the remaining Solomon Islands endemic, *pulchella*, do not have such hairs. These last two may be easily separated by the gastral sculpture, which consists of coarse punctures in *mayri* and longitudinal striation in *pulchella*.

Triglyphothrix meshena sp. n.

(Text-figs 51, 67)

Holotype worker. TL 3·4, HL 0·74, HW 0·70, CI 94, SL 0·46, SI 66, PW 0·54, AL 0·82.

Antennal scrobes strongly developed, with a distinct, sharp dorsal margin and a marked median longitudinal carina. Outline shape of alitrunk as in Text-fig. 67. Propodeal spines short and stout, acute, approximately as long as their basal width and scarcely longer than the metapleural lobes. Petiole in profile massive, with a long anterior face and a short, broad peduncle. Postpetiole also massively built, in profile blocky, subrectangular in shape and higher than long. In dorsal view the petiole node as wide as long. Dorsal surfaces of head, alitrunk, petiole and post-petiole finely and densely reticulate-rugose. Basal portion of first gastral tergite coarsely punctate. Mandibles striate. Dorsal surfaces of head, body and appendages covered with a dense mat of erect or suberect trifid hairs, elongate simple hairs absent.

Paratype workers. TL 3·1–3·4, HL 0·70–0·74, HW 0·68–0·70, CI 94–97, SL 0·44–0·46, SI 63–68, PW 0·54–0·56, AL 0·80–0·82 (7 measured). Otherwise as holotype.

Holotype worker, WEST MALAYSIA: Selangor, Gombak, 7.x.1973 (*B. Bolton*) (BMNH).

Paratypes. 5 workers with same data as holotype; 2 workers, WEST MALAYSIA: Selangor, Ulu Gombak For. Reserve, 24.viii.1967, tree lookout area, ca 450 m, hill forest (*R. Crozier*) (BMNH; MCZ, Cambridge).

Most closely related to *adpressa*; notes on the differences of the two species are given under *adpressa*.

A number of specimens in the MCZ, Cambridge collection are also referable to this species. These include three short series from JAVA collected by Dammerman at Depok, 23.xii.1923 (2 workers and a female); Buitenzorg (= Bogor), 18.xii.1922 (2 workers); Buitenzorg, Tjampea, 19.x.1922 (1 worker).

The series from Bogor compare perfectly with the type-series, but the specimens from Depok have less massively built pedicel segments and shorter, more obviously reclinate branched hairs on the head and also to some extent upon the gaster. Whether these specimens represent part of the natural variation of *meshena* or a link in the direction of *adpressa* or indeed a separate species, cannot be decided on the few specimens presently available, but I note their existence here to bring them to the attention of any future worker on this group.

Triglyphothrix nacta sp. n.

Holotype worker. TL 3·0, HL 0·78, HW 0·76, CI 97, SL 0·50, SI 66, PW 0·56, AL 0·82.

Antennal scrobes strongly defined dorsally and posteriorly, much more weakly delimited ventrally. Median longitudinal carina of scrobe extending back to level of posterior margin of eye and quite distinct. Eyes relatively small, their maximum diameter ca 0·14, only very slightly greater than the maximum width of the antennal scape. Dorsal alitrunk evenly convex in profile, the propodeal spines short, narrow and acute. Metapleural lobes large, lobate, roughly semicircular and longer than the propodeal spines. Petiole node relatively high in profile, the tergal portion of the node higher than long. Postpetiole rounded above in profile, the sternal portion forming a distinctly projecting, roughly rectangular mass ventrally. In dorsal view the petiole is subglobular, slightly broader than long and broadest at about its midlength. Mandibles coarsely striate. Dorsum of head finely and irregularly longitudinally rugose, without reticulations except near the occiput. Dorsal alitrunk, petiole and postpetiole densely reticulate-rugulose, the gaster smooth and shining. Entire head and body densely clothed with trifid hairs, those of the first gastral tergite universally trifid. Simple hairs absent except for one or two relatively short ones which occur on the upper margin of the frontal carina where it forms the dorsal border of the scrobe, but these hairs are not exceptional and are difficult to distinguish from the surrounding branched pilosity. Colour uniform medium brown.

Paratype workers. As holotype, with range of dimensions TL 2·9–3·1, HL 0·76–0·80, HW 0·72–0·78, CI 96–100, SL 0·48–0·52, SI 63–68, PW 0·52–0·56, AL 0·76–0·84 (15 measured).

Holotype worker, THAILAND: Nong Hoi, 19.vii.75, in soil (*D. Jackson*) (BMNH).
Paratypes. 19 workers with same data as holotype (BMNH; MCZ, Cambridge).
This species is certainly most closely related to *parvispina* but is a much larger, more robust form in which the petiole is relatively higher and narrower.

Triglyphothrix obesa (André)

Tetramorium obesum André, 1887 : 294. Syntype workers, INDIA: Gingi (MCZ, Cambridge; MNHN, Paris) [examined].
Triglyphothrix obesa (André); Emery, 1891 : 4.

Worker. TL 3·1–3·5, HL 0·78–0·84, HW 0·76–0·82, CI 95–98, SL 0·54–0·58, SI 68–76, PW 0·54–0·58, AL 0·86–0·90 (7 measured).

Antennal scrobes developed, with a distinct dorsal margin but with the median longitudinal carina weakly developed or in some indistinguishable from the surrounding sculpture. Upper portion of scrobe usually less strongly sculptured than the lower. Propodeal spines long, narrow and acute, generally two or more times longer than the metapleural lobes, which are acute and upcurved. Petiole in profile with the dorsal and posterior faces united in a single convex surface, the petiole more massively developed than the postpetiole. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely reticulate-rugose, the reticulation tending to be more strongly developed on the posterior portion of the cephalic dorsum than the anterior, where often only longitudinal rugulae are present. First gastral tergite unsculptured. Mandibles smooth, with scattered pits but without striation. All dorsal surfaces of head and body with numerous branched (bifid and trifid) hairs, also with numerous elongate, simple hairs. Leading edge of antennal scapes and outer surfaces of middle and hind tibiae with abundant long hairs, the longest of which are at least as long as the maximum width of the appendage upon which they arise. Colour orange-brown to reddish brown.

Closest related to *lanuginosa*, *obesa* may be separated by the characters given in the key. In general the presence of mandibular striae in *lanuginosa* is sufficient to separate the two, and this character has been used on a number of occasions (Forel, 1902*b*; Bingham, 1903; Mann, 1919) to isolate *obesa*. Unfortunately a number of small individuals of *lanuginosa* are now known in which the mandibular striation is reduced or even absent, but in these the HW range falls considerably below the minimum for *obesa* and the array of branched hairs on the first gastral tergite lacks trifid members, some of which are invariably present in *obesa*, at least basally.

MATERIAL EXAMINED.

INDIA: Travancore (*Ferguson*); Kerala State, Perumanna Village (*A. B. Soans*); Kerala State, Nilambur (*A. B. Soans*). BURMA: Ruby Mines District (*Bingham*); Pegu Yoma (*Bingham*).

Triglyphothrix pacifica Mann

Triglyphothrix pacifica Mann, 1921 : 460. Syntype workers, female, FIJI ISLANDS: Viti Levu, Nadarivatu (*W. M. Mann*) (MCZ, Cambridge) [examined].

Worker. TL 2·5–3·0, HL 0·68–0·70, HW 0·60–0·64, CI 88–91, SL 0·48–0·50, SI 77–80, PW 0·50–0·52, AL 0·76–0·82 (6 measured).

Antennal scrobes weakly developed, with a poorly defined dorsal margin and a very weak, meandering median longitudinal carina which is not more strongly developed than adjacent rugulae. Propodeal spines long and acute, longer than the metapleural lobes. Node of petiole blocky and massive, larger than the postpetiole in profile. Mandibles striate. Dorsal surfaces of head, alitrunk and petiole finely reticulate-rugose, dorsal surface of postpetiole unsculptured, smooth and shining or at most with vestigial traces of sculpture. First gastral tergite unsculptured. Leading edge of antennal scapes and outer margins of middle and hind tibiae with short hairs only which are less than half the maximum width of the appendage from which they arise. Dorsal surfaces of head, alitrunk and pedicel with a mixture of simple and branched hairs and with some elongate, simple hairs on head. Hairs on first gastral tergite either almost universally simple, or with bifid hairs present. Colour light reddish brown to dark brown.

Apart from a few small individuals of *striatidens* this is the only known species of *Triglyphothrix* outside the Ethiopian region which has the postpetiole unsculptured. This single character serves to separate *pacifica* from its closest relatives also. It is the only endemic species of this genus known from the Fiji Islands, and the species appearing to be closest related are *antennata* and *vombis*, both endemic in the Solomon Islands.

MATERIAL EXAMINED.

FIJI ISLANDS: Nausori Highlands, SW. Fiji (*W. L. & D. E. Brown*); Viti Levu, Nadala (*E. O. Wilson*).

Triglyphothrix parvispina Emery

(Text-fig. 64)

Triglyphothrix parvispina Emery, 1893 : 214 [diagnosis in key]. Syntype (?) workers, BORNEO (?): Poulo Laut (*Bedot & Pictet*) (MCSN, Genoa).

Triglyphothrix parvispina var. *formosae* Forel, 1912*a* : 52. Syntype workers, TAIWAN: 'Formosa', Pilam (*H. Sauter*) (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 2·4–2·6, HL 0·60–0·66, HW 0·56–0·62, CI 93–97, SL 0·40–0·44, SI 70–75, PW 0·40–0·48, AL 0·64–0·70 (6 measured).

Antennal scrobes strongly developed, with a sharply defined, narrow, flange-like dorsal margin and a well-differentiated median longitudinal carina. Propodeal spines short, reduced to a pair of triangular, acute teeth which are at most only as long as the metapleural lobes, often shorter. Metapleural lobes low and rounded, not developed into upcurved teeth. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose, first gastral tergite unsculptured. All dorsal surfaces of body densely clothed with short, predominantly branched (trifid) hairs. Long, erect hairs absent.

On the whole this species shows a close resemblance to *kheperra* and their separation at present rests rather uneasily upon the relative lengths of the propodeal spines. Further collections may show that the two species intergrade.

With some reservation I refer to *parvispina* two specimens in MCZ, Cambridge collection with data as follows: [CHINA:] Foochow, Peta (*F. Silvestri*). These may represent a variant population of *parvispina* or may be a separate species. The main character setting them somewhat apart from my concept of *parvispina* is the array of hairs on the gaster which in these specimens is primarily a mixture of simple and bifid hairs, whilst in *parvispina* the gastral hairs are predominantly trifid. Despite this I feel that it would be unwise to separate these specimens from *parvispina* at the present time as collections are too few to allow a sound judgement to be made.

MATERIAL EXAMINED.

PHILIPPINES: Dumaguete (*J. W. Chapman*); Dumaguete (*D. Empeso*).

***Triglyphothrix pnyxis* sp. n.**

(Text-fig. 70)

Holotype worker. TL 2·9, HL 0·68, HW 0·62, CI 91, SL 0·48, SI 77, PW 0·46, AL 0·76.

Upper border of antennal scrobe demarcated by the irregular line at which the cephalic sculpture terminates, without a flange or narrow, acute margin formed by the frontal carinae. Posteriorly and ventrally the scrobe margins are even less well defined than this, being indicated merely by a change in sculpturation. Median carina of scrobe present but very weak. Propodeal spines narrow and acute, longer than the triangular metapleural lobes. Node of petiole in profile long and low, distinctly longer than high. In dorsal view the node longer than broad, broadest posteriorly and quite narrowly rounded in front. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely and closely reticulate-rugulose. Mandibles striate; gaster smooth and shining. All dorsal surfaces of head and body densely covered with trifid hairs; the hairs on the first gastral tergite universally trifid. A few very fine simple hairs are present on the dorsum of the head but the upper margins of the scrobes are without a regular spaced row of elongate simple hairs. Colour dark red-brown, the appendages yellow-brown.

Paratype worker. As holotype, differing only in that HW is 0·50 and SI 80.

Holotype worker, WEST MALAYSIA: Trengganu, Gn. Lawit, summit ridge, 4200 ft, 11.iii.1974 (*T. Clay*) (BMNH).

Paratype. A single worker with same data as holotype (MCZ, Cambridge).

Amongst the five species making up the *kheperra*-complex in the *walshi*-group, two species, *pnyxis* and *katypa*, have a petiole node which is elongate and low in profile. The two are quickly separable as *katypa* has a sharply defined dorsal margin to the antennal scrobe from which projects a row of elongate, simple hairs which are stout and very conspicuous. In *pnyxis* on the other hand the dorsal margin of the scrobe is feebly marked and elongate simple hairs are absent from it.

***Triglyphothrix pulchella* Mann**

Triglyphothrix pulchella Mann, 1919 : 352, fig. 31. Syntype workers, female, SOLOMON ISLANDS: Malaita, Auki (*W. M. Mann*) (MCZ, Cambridge) [examined].

Worker. TL 2·4–2·6, HL 0·56–0·62, HW 0·52–0·54, CI 89–93, SL 0·38–0·42, SI 72–77, PW 0·40–0·42, AL 0·62–0·66 (3 measured).

Antennal scrobes shallow, with a poorly defined upper margin and a weak, feebly differentiated median longitudinal carina. Propodeal spines long, narrow and acute, much longer than the metapleural lobes. Dorsal surfaces of head, alitrunk and pedicel finely reticulate-rugose. Mandibles striate. Basal one-third or more of first gastral tergite with strong longitudinal striation. Dorsal surfaces of head and body densely coated with short branched (trifid) hairs, long, simple hairs absent. Leading edges of antennal scapes and outer margins of tibiae with a dense coat of short hairs of approximately equal length, without elongate, simple hairs. Colour yellow, the head and gaster generally a lighter shade than the alitrunk and pedicel.

This distinctive small species is endemic in the Solomon Islands and appears to be closely related to *fulviceps* of New Guinea. The diagnostic notes above should serve to separate this species from other endemic species found in the Solomon Islands.

MATERIAL EXAMINED.

SOLOMON ISLANDS: Malaita I., Dala (*P. Greenslade*); Nggela I. (*P. Greenslade*); Isabel I., Buala (*P. Greenslade*).

Triglyphothrix rossi **sp. n.**

Holotype worker. TL 2·8, HL 0·62, HW 0·56, CI 90, SL 0·48, SI 86, PW 0·42, AL 0·72. Antennal scrobes very poorly developed, virtually erased, the extensions of the frontal carinae which form the upper scrobe margins are extremely weak and cannot be distinguished from the other sculpture behind the level of the eyes. Scrobal area not differentiated from rest of the head, without a median carina, the scrobal area almost or quite as strongly sculptured as the cephalic dorsum. Dorsal alitrunk evenly convex in profile, terminating in a pair of narrow propodeal spines. Metapleural lobes dentiform and directed upwards. Petiole in profile shaped as in *lanuginosa* (Text-fig. 63) but with the antero-dorsal angle more rounded. In dorsal view the petiole broadly triangular with a broadly rounded, blunt apex anteriorly, broadest posteriorly where its maximum width is equal to the width of the postpetiole. Dorsal surfaces of head, alitrunk and the pedicel segments with a fine rugoreticulum. Mandibles striate. Gaster smooth and shining, unsculptured. All dorsal surfaces of head and body with a mixture of simple and bifid hairs, very distinctive on the first gastral tergite. Dorsum of head with a row of long, erect, simple hairs along the line of the frontal carinae and with scattered long, simple hairs elsewhere on the head and dorsal alitrunk. Outer surfaces of middle and hind tibiae with numerous suberect to subdecumbent hairs which are all of approximately the same length and are much shorter than the maximum tibial width. Leading edges of antennal scapes without long simple hairs which are greater in length than the maximum scape width. Colour uniform dark brown, the appendages lighter.

Paratype worker. As holotype, with size range TL 2·6–2·9, HL 0·60–0·66, HW 0·54–0·58, CI 85–90, SL 0·46–0·52, SI 85–89, PW 0·40–0·46, AL 0·68–0·76 (10 measured).

Holotype worker, INDIA: South, 8 miles NE. Munnar, 6200 ft, 20.iii.1962 (*E. S. Ross & D. Q. Cavagnaro*) (CAS, San Francisco).

Paratypes. 32 workers and 1 female mounted, a number of other workers plus brood in alcohol; with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge).

Within the *obesa*-group *rossi* is most closely related to *coonoorensis*. Both species have reduced antennal scrobes and both are endemic in the Indian subcontinent. *T. rossi* is separated from *coonoorensis*, and also from the remainder of the *obesa*-group, by its lack of long simple hairs on the leading edge of the antennal scape. In all its allies these hairs are very long, generally longer than the maximum width of the scape.

***Triglyphothrix vombis* sp. n.**

(Text-fig. 73)

[*Triglyphothrix obesa* (André) sensu Mann, 1919 : 349. Misidentification.]

Holotype worker. TL 3·1, HL 0·72, HW 0·66, CI 92, SL 0·48, SI 73, PW 0·50, AL 0·80.

Antennal scrobes strongly developed, with a sharply defined dorsal margin and a weak but distinct median longitudinal carina. Propodeal spines narrow and acute, slightly longer than the acute metapleural lobes. Petiole in profile with the dorsal and posterior faces united in a single convex surface; the postpetiole about as high as the petiole. Mandibles mostly smooth but with a few scattered pits and vestiges of longitudinal striation in places. Dorsal surfaces of head, alitrunk and pedicel finely and densely reticulate-rugose. First gastral tergite smooth and shining. Head, alitrunk and pedicel densely clothed with fine hairs, the majority of which are simple, relatively few bifid hairs being present. Hairs on first gastral tergite universally simple. Dorsum of head and alitrunk also with a number of long, simple hairs. Outer margins of tibiae of middle and hind legs with a dense coat of short hairs, all of approximately equal length and less than half the maximum width of the tibia upon which they arise. Colour light orange-brown, the gaster yellowish brown.

Paratype workers. TL 2·9–3·1, HL 0·70–0·72, HW 0·64–0·66, CI 91–94, SL 0·46–0·50, SI 70–75, PW 0·46–0·50, AL 0·76–0·80 (7 measured). As holotype but in some the mandibles smooth, without trace of striation.

Holotype worker, SOLOMON IS.: Ugi (*W. M. Mann*) (MCZ, Cambridge).

Paratypes. 7 workers, 1 female, same data as holotype (MCZ, Cambridge; BMNH).

Originally described by Mann (1919) as *obesa*, this species is in fact distinct and belongs to a complex containing also *antennata*, *brevidentata*, *chepocha* and *pacifica*. It is easily distinguished from *obesa* and its allies by its lack of varying-length simple hairs on the tibiae, having instead a dense coat of short hairs of uniform length.

***Triglyphothrix walshi* Forel**

(Text-fig. 68)

Triglyphothrix walshi Forel, 1890 : cvii. Syntype workers, female, INDIA: Bengal, Poree (*J. Walsh*), and Poona (*R. C. Wroughton*) (MHN, Geneva) [examined].

Triglyphothrix musculus Forel, 1902*a* : 239. Syntype workers, INDIA: Coonoor (*Wroughton*) (MHN, Geneva) [examined]. **Syn. n.**

Triglyphothrix walshi var. *spuria* Forel, 1912*c* : 58. Syntype workers, SINGAPORE and SRI LANKA: Colombo (*A. Müller*) (MHN, Geneva) [examined]. **Syn. n.**

Worker. TL 2·3–2·8, HL 0·56–0·68, HW 0·52–0·66, CI 93–98, SL 0·32–0·48, SI 61–67, PW 0·40–0·54, AL 0·54–0·74 (14 measured).

Antennal scrobes strongly developed, with a sharply defined dorsal margin and a distinct median longitudinal carina. Alitrunk in dorsal view short and broad, compact, the pronotal angles sharp, giving the species a square-shouldered appearance. Propodeal spines acute, longer than the metapleural lobes. Node of petiole in dorsal view strongly antero-posteriorly compressed, transverse, distinctly broader than long. Dorsal surfaces of head, alitrunk, petiole and postpetiole finely reticulate-rugose, the rugosity sometimes reduced on the postpetiole. First gastral tergite usually with the basal one-third or more finely longitudinally striate, often with punctures between the striae, but in some populations from Sri Lanka this sculpture is reduced or absent. Head, body and appendages uniformly clothed with a dense mat of fine, trifid hairs, the head also with a few elongate simple erect hairs which are longer than the neighbouring trifid hairs and which are present at least on the dorsal surface of the upper margins of the scrobes. Colour light to dark brown.

In a number of ways this species resembles the Ethiopian region forms related to *inezulae* more than any other species. The resemblance to *thoth* is particularly striking and further investigation of their relationship would be interesting when *thoth* is better known. Suffice to say that the two seem distinct as *thoth* lacks erect simple hairs on the head, has reduced propodeal spines and has the gaster unsculptured.

MATERIAL EXAMINED.

INDIA: Kanara (*Wroughton*); no loc. (coll. Bingham); Izatnagar (ex C.I.E. coll.); Nilgiris (?); Cochin (*Rothney*); Kerala State, Silent Valley Reserve (*A. B. Soans & W. L. Brown*); Kerala State, Peruva (*A. B. Soans & W. L. Brown*); Irinjalakuda (*A. B. Soans*); Calicut (*A. B. Soans*); Madras Presidency, Chilka Lake (?); Wallon? (ex coll. Wasmann). SRI LANKA: Colombo (*W. L. Brown*); Gilimale (*E. O. Wilson*); Nuwara Eliya (*K. L. A. Perera*). CHINA: Foochow (*H. H. Chung*). PHILIPPINES: Dumaguete (*J. W. Chapman*); Dumaguete, Silliman University (*D. Empeso*).

TETRAMORIUM Mayr

Tetramorium Mayr, 1855 : 423. Type-species: *Formica caespitum* L., 1758 : 581; by subsequent designation of Giraud, 1879 : 1016.

Tetrogmus Roger, 1857 : 10. Type-species: *Tetrogmus caldarius* Roger, op. cit.: 12 [= *Tetramorium simillimum* (F. Smith), 1851 : 118]; by monotypy. [Synonymy by Mayr, 1863 : 456.]

Xiphomyrmex Forel, 1887 : 385 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Xiphomyrmex*) *kelleri* Forel, loc. cit.; by subsequent designation of Wheeler, 1911 : 175. **Syn. n.**

Xiphomyrmex Forel; Emery, 1896*a* : 183; 1914*a* : 42. [Raised to genus.]

Atopula Emery, 1912 : 104. Type-species: *Atopomyrmex nodifer* Emery, 1901 : 115; by original designation. **Syn. n.**

Macromischoides Wheeler, 1920 : 53. Type-species: *Macromischa aculeata* Mayr, 1866 : 507; by original designation. **Syn. n.**

Sulcomyrmex Kratochvíl, 1941 : 84 [as subgenus of *Tetramorium*]. [Proposed without designation of type-species; name not available.]

Lobomyrmex Kratochvíl, 1941 : 84 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Lobomyrmex*) *ferox silhavyi* Kratochvíl, loc. cit. [= *Tetramorium ferox* Ruzsky, 1903 : 309], by monotypy. **Syn. n.**

DIAGNOSIS. *Worker.* Mandibles with three teeth apically, the third smaller than the second and followed by a row of 3–7 small or minute denticles; the arrangement 3 teeth plus 4 denticles overwhelmingly predominant. Palp formula 4, 3 (47 species dissected), very rarely 4, 2 (1 species) or 3, 2 (1 species). (The formula 3,3 has not been detected but probably occurs in some minute species as in *Triglyphothrix*.) Antennae 11- or 12-segmented, the three apical antennomeres forming a club. Eyes present, usually moderate to large, very rarely reduced or minute. Frontal carinae strongly developed in most species, reaching almost to the occipital margins, but in a few groups (e.g. *caespitum*-group; *sericeiventre*-group) and a number of isolated species reduced and petering out before the level of the eyes. Median longitudinal clypeal carina usually distinct, reduced or absent in only a few species. Cephalic median carina generally developed but not uncommonly reduced or absent. Antennal scrobes showing all stages of development from absent to deep, but in the latter case the scrobe is only very rarely divided into upper and lower compartments by a longitudinal ridge or carina. Alitrunk fusiform, without sutures, but the metanotal groove is impressed in many species. Propodeum usually armed with a pair of spines or teeth, only very rarely unarmed. Metapleural lobes present, usually acute or dentiform but sometimes reduced and rounded, sometimes minute or vestigial. Petiole pedunculate, without a large ventral process. Lamelliform appendage of sting variable in shape, triangular, dentiform, pennant-shaped or spatulate. Tibial spurs present on middle and hind legs in many large species, usually simple but in a few they may be minutely barbulate. In some smaller and some larger species the spur is absent or indistinguishable from the adjacent pilosity. Pilosity very variable; usually with numerous erect or suberect hairs on all dorsal surfaces but these may be absent from various sclerites, reduced in number and size, appressed, or rarely completely absent. Very rarely the pilosity is bizarre, the hairs being spatulate, short-clavate, palmate, plumose or pinnate, but never with regularly bifid, trifid or quadrifid hairs.

Female. As worker but with flight sclerites and ocelli, the virgin queens fully alate.

Male. Known for only very few species. Antennae 10 to 11-segmented, the second funicular forming an elongate fusion-segment. Mandibles dentate. Palp formula as worker. Pilosity variable as in worker, without the branched hairs characteristic of *Triglyphothrix*.

As defined above *Tetramorium* is a large compact genus which, on recent count, included some 465 named forms, of which I suspect that about 200–250 are valid. As was the case with *Triglyphothrix* it is apparent that numerous common species of *Tetramorium* have been described many times and have quite a lot of infraspecific or infrasubspecific names attached to them whilst of the less common forms a great number of valid species remain undescribed. Revision of this great mass of names is at present in progress and I have already completed studies on the species with 11-merous antennae which formerly constituted the genus *Xiphomyrmex*, now synonymized (see below). I envisage the revision of *Tetramorium* as being published in two or three sections, each dealing with a fairly restricted faunal area but it is already obvious that the Ethiopian/Malagasy fauna is by far the largest and seems to present the most problems of a taxonomic nature.

The distribution of *Tetramorium* embraces all of the Old World tropics and subtropics and the Palaearctic and Nearctic Regions. The only region without any endemic species is the Neotropical but even here a few species have been introduced by accident and now appear to be flourishing. The principle nest-sites of this genus include rotten wood, under stones or directly into the earth but a few species are known which are arboreal, nesting either in the wood, under bark, or constructing carton nests of vegetable fibre and debris. The majority of species are cryptic or retiring forms but some are very distinctive and run actively on the surface of the ground or on trees.

Generic synonymy of *Tetramorium*

Xiphomyrmex. When Forel (1887) described *Xiphomyrmex* he made it a subgenus of *Tetramorium*, stating that the only difference between them was contained in the number of antennal segments which each possessed, namely eleven for *Xiphomyrmex* and twelve for *Tetramorium*. Emery (1896*a*; 1914*a*) considered that this difference was sufficient to raise *Xiphomyrmex* to generic status and this view was endorsed by Wheeler (1922). Arnold (1917; 1926) on the other hand continued to treat *Xiphomyrmex* as a subgenus. In later years, as various new species were described, they were assigned to one of these two groups solely on their antennomere count, without regard for any other characters which they possessed.

Whilst studying *Triglyphothrix* and *Rhoptromyrmex* it became obvious that it was possible for antennal segmentation to vary within genera in this tribe without affecting characters of generic significance, which remained stable, and this prompted a search for definitive characters which could be used to separate *Tetramorium* and *Xiphomyrmex*. No new characters could be found, but Brown (1973) had noted that the sting appendage in workers and females was 'perpendicular to the shaft and sharply dentiform or pennant-shaped' in *Tetramorium*, whilst in *Xiphomyrmex* the sting appendage was 'Rounded-spatulate'.

On investigation it was found that the rounded-spatulate appendage, supposedly confined to *Xiphomyrmex*, also occurred in *Tetramorium* (as defined by their 12-merous antennae) throughout the *grassii-* and *squaminode*-groups, and that an appendage perpendicular to the long axis of the sting or inclined at an angle to it occurred in the *carinatum-* and *schaufussi*-groups of *Xiphomyrmex* (as defined by their 11-merous antennae). Examination of a large number of species further appeared to show that a straight-spatulate appendage may be derived from a perpendicular-dentiform structure. The main forms of sting appendage and the antennomere counts are tabulated below, with some examples.

1. Sting appendage perpendicular or slightly inclined from long axis of shaft, acute apically.	Antennae with 12 segments: *camerunense*-group, *caespitum*-group, *sericeiventre*-group, *guineense*-group. Antennae with 11 segments: *striolatum*-group.
2. Sting appendage perpendicular or slightly inclined from long axis of shaft, blunt apically.	Antennae with 12 segments: part of *grassii*-group and of *squaminode*-group. Antennae with 11 segments: *carinatum*-group.
3. Sting appendage continuing long axis of shaft (may be feebly upcurved), blunt apically.	Antennae with 12 segments: part of *grassii*-group and of *squaminode*-group. Antennae with 11 segments: *muralti*-group, *angulinode*-group.
4. Sting appendage continuing long axis of shaft; blunt and upcurved apically.	Antennae with 11 segments: *weitzeckeri*-group, *angulinode*-group.

The species in the first category may be regarded as 'super-*Tetramorium*' and those in the fourth as 'super-*Xiphomyrmex*' when sting structure alone is considered but it is obvious that all possible intergrades exist, regardless of their antennomere count. As there are absolutely no other characters which can be considered it is apparent that *Tetramorium* is capable of showing the same variation as *Triglyphothrix* and *Rhoptromyrmex* as regards antennal segmentation, and *Xiphomyrmex* falls into the synonymy of *Tetramorium*.

Once this has been accepted a number of interesting correspondences become apparent. For instance, the *weitzeckeri*-group (formerly of *Xiphomyrmex*) is inseparable from the *squaminode*-group (formerly of *Tetramorium*) in all characters except that of antennal segmentation, and the closest relatives of *T. grassii* seem to be the former *Xiphomyrmex* species of the *schaufussi*-group.

In view of the above it seems most probable that the antennomere count of eleven has arisen independently and at different times from a number of species-groups with 12-segmented antennae within *Tetramorium.* One interesting point arising from the 11- versus 12-merous antennae is the fact that *Tetramorium* in which the antennae are 11-segmented are predominant in Australia and Madagascar, where they outnumber the 12-segmented forms in terms of numbers of endemic species, whereas elsewhere they form a relatively minor part of the fauna. It can be postulated from this relict distribution that the parts of the genus with 11-segmented antennae and relatively unspecialized body-form (this excludes the very specialized *weitzeckeri*-group) represent the remnants of an earlier radiation of the genus which has since been in large part replaced by their later-radiating 12-segmented congeners. This presupposes that the early loss of an antennomere in some groups somehow gave its owners an early advantage over their relatives which retained the ancestral 12-merous antennae but that a later change of circumstance obviated this advantage and the 12-merous species then overhauled and gradually replaced their 11-merous allies except in peripheral or inaccessible parts of the range.

This is of course speculation but it does fit the present facts of distribution as regards 11- versus 12-segmented antennae and may even explain why a single endemic 11-segmented species is still found in North America, the only holarctic endemic species with this antennomere count.

Atopula. Emery (1912) created the genus *Atopula* to contain two species which he had described previously (Emery, 1901) in *Atopomyrmex* André. These were *A. nodifera* (made the type-species of *Atopula*) from Cameroun, and *A. ceylonica* from Sri Lanka (which Emery referred to as *ceylonensis* in his 1912 publication).

Wheeler (1919) recognized that these two species were different at generic level and, disagreeing with Forel's (1917) placement of *ceylonica* in *Leptothorax* Mayr, erected a new genus *Paratopula* to hold *ceylonica* and its infraspecific forms. This procedure meant that *Atopula* at that time contained only its type-species, *nodifera*, but later authors added a few more names to the genus.

Unfortunately the type-species, *Atopula nodifera,* is a quite ordinary tetramoriine, with all the diagnostic tribal characters, and furthermore the generic name *Atopula* is a straight synonym of *Tetramorium.* (Palp formula of 4,3 confirmed by dissection of BMNH specimen. Syntype worker of *nodifera* examined at MCZ, Cambridge.)

Having established this point, the generic identity of the three remaining species of *Atopula* must now be clarified.

Atopula belti (Forel) was placed in the monotypic genus *Brunella* Forel (1917), and for the time being I think that *belti* is best returned to *Brunella* until it can be investigated in detail. It is certainly not a tetramoriine and its affinities are unclear.

Atopula longispina Stitz (1938) appears to be close to *ceylonica* and its allies and is transferred to *Paratopula*; thus its name is now *Paratopula longispina* (Stitz) **comb. n.**

Atopula hortensis Bernard (1948) is a tetramoriine. In fact it is a direct junior synonym of the common African species *Tetramorium sericeiventre* Emery, and I am amazed that it was not recognized as such by Bernard as its identity is immediately obvious merely by examining the figures which he gives (Bernard, 1948 : 174, fig. 9). *T. sericeiventre* is the most common arid-ground and semi-desert inhabiting species of its genus in the entire Ethiopian region and should be well known to anyone who is acquainted with the ant fauna of the region.

Macromischoides. When Wheeler (1920) first introduced the name *Macromischoides* he cited a type-species (*Macromischa aculeata* Mayr) but did not define the genus. Later he gave a diagnosis and notes on the genus (Wheeler, 1922) and in the catalogue in the same publication he assigned the genus to the tribe Leptothoracini, in which it was retained by numerous later authors despite the fact that Santschi (1924) had demonstrated its tetramoriine character. Santschi's findings are confirmed here and it is shown that Emery (1896*b*) was correct in assigning the known species of this group to genus *Tetramorium*.

In his diagnosis of the genus Wheeler (1922) does not cite any characters which differentiate *Macromischoides* from the mass of *Tetramorium* except for the fact that the palp formula is reduced to 3,2 from the primitive maximum tetramoriine count of 4,3. Taken as it stands Wheeler's definition of *Macromischoides* is really no more than a short description of its type-species, and the characters of the only other species which he included, *africanum*, are not noted. In fact *africanum* is summarily dismissed with the comment that it is 'hardly more than a subspecies of *aculeata*'. This statement is incorrect and a close examination of *africanum* reveals that it shows numerous characters intermediate between *aculeatum* and the less specialized members of *Tetramorium*. In particular, the palp formula of *africanum* (4,2) is the main character which destroys the validity of *Macromischoides* as it is intermediate between the great mass of the genus (PF 4,3) and the specialized *aculeatum* (PF 3,2). All the other characters given by Wheeler are paralleled elsewhere in *Tetramorium*, particularly in the *carinatum*-group which, through adoption of a sub-arboreal lifeway, show similar modifications in body form but retains the palp formula of 4,3.

A character cited by Wheeler (1922) for the males of *Macromischoides* concerns the antennomere count in the male of *aculeatum*, which Wheeler gives as eleven. He states that 'Mayr claimed that the male *aculeata* has 11-jointed antennae, but Emery, after examination of six specimens, maintained that these appendages are 10-jointed'. Santschi (1924) proved that the funicular segmentation of the male showed considerable variation in degree of fusion of the antennomeres and this is confirmed in the present study, which also indicates that such variation is quite common throughout the males of this genus.

Wheeler (1922) was of the opinion that *Tetramorium* became more homogeneous with the removal of *aculeatum* and *africanum* to a separate genus. I completely disagree with this statement as dividing up a genus by artificial and arbitrarily drawn lines often generates rather than removes confusion because the definition of the genus-group names thus produced becomes extremely difficult or impossible. This increased difficulty of definition is implicit in the process of splitting a genus by these means as it is usually accomplished by cutting out one or two species from the main mass of the genus which are said to show derived or specialized characters whilst leaving the closest relatives of the derived forms in the parent genus, from which they cannot be separated.

The subgenera *Lobomyrmex* and *Sulcomyrmex*. Kratochvíl (1941; 1944) attempted to overhaul the *Tetramorium* species of central Europe in general and Czechoslovakia in particular, and in doing so fell into the strange trap of splitting the few central European species into three subgenera, apparently without realizing that subgeneric names cannot be applied on such a limited basis but, once designated, apply to the entire world fauna and include all species of the genus which possess the characters delimited. As soon as this is given objective consideration his subgenera collapse in a welter of derivative forms and species or whole species-groups which overlap or refuse to comply with his subgeneric limits.

The subgenus *Sulcomyrmex* was said to contain the species *simillimum* and *guineense* (both of which are tramp species not endemic in the Palaearctic region) and was defined by the fact that the frontal carinae extend back to the occipital margin. On this character *Sulcomyrmex* would contain the vast majority of the world fauna but unfortunately for the subgenus some species of the *guineense*-, *pacificum*-, *simillimum*- and many other species-groups exist in which the frontal carinae are reduced or lost in some species but not in others, as was recognized by Arnold as long ago as 1917. Consideration must also be given to the *squaminode*-group, the *occidentale*-group and the *weitzeckeri*-group. The members of these groups have strongly developed frontal carinae, which would place them firmly in *Sulcomyrmex*, but also have a petiolar and postpetiolar structure which would place them equally firmly in *Lobomyrmex*, the next to be discussed.

In subgenus *Lobomyrmex* the frontal carinae are stated as being short, not extending to the occipital margin, and the pedicel is defined as having the 'petiole dorsally almost as broad or only slightly narrower than the postpetiole'. In contrast to this the third subgenus, *Tetramorium* sensu stricto, as well as having short frontal carinae has, 'petiole dorsally always distinctly narrower than postpetiole; if not distinctly then . . .', and one is already on very unfirm ground, as can be deduced from the ambiguous nature of the couplet. Factually, all that this couplet set out to do was to separate *T. ferox* and its allies (subgen. *Lobomyrmex*) from *T. caespitum* and its allies (subgen. *Tetramorium* sensu stricto) which in reality only belong to different complexes of species within a single very compact species-group. Applying the definitions of these subgenera to the rest of the world fauna produces unbelievable results as, in almost all groups in which the frontal carinae are reduced in all species (*aculeatum*-group, *solidum*-group, *sericeiventre*-group), as opposed to the many groups in which only one or two species have the carinae reduced, some species fall into one subgenus and some into another, and again the question arises as to where to place the *squaminode*- and related groups.

I think that this is sufficient to show the artificiality of these subgenera and the impossibility of dividing up the world fauna solely from the study of less than a dozen species from a restricted area of the Palaearctic region, especially when the main fauna of this genus is strictly tropical in its distribution.

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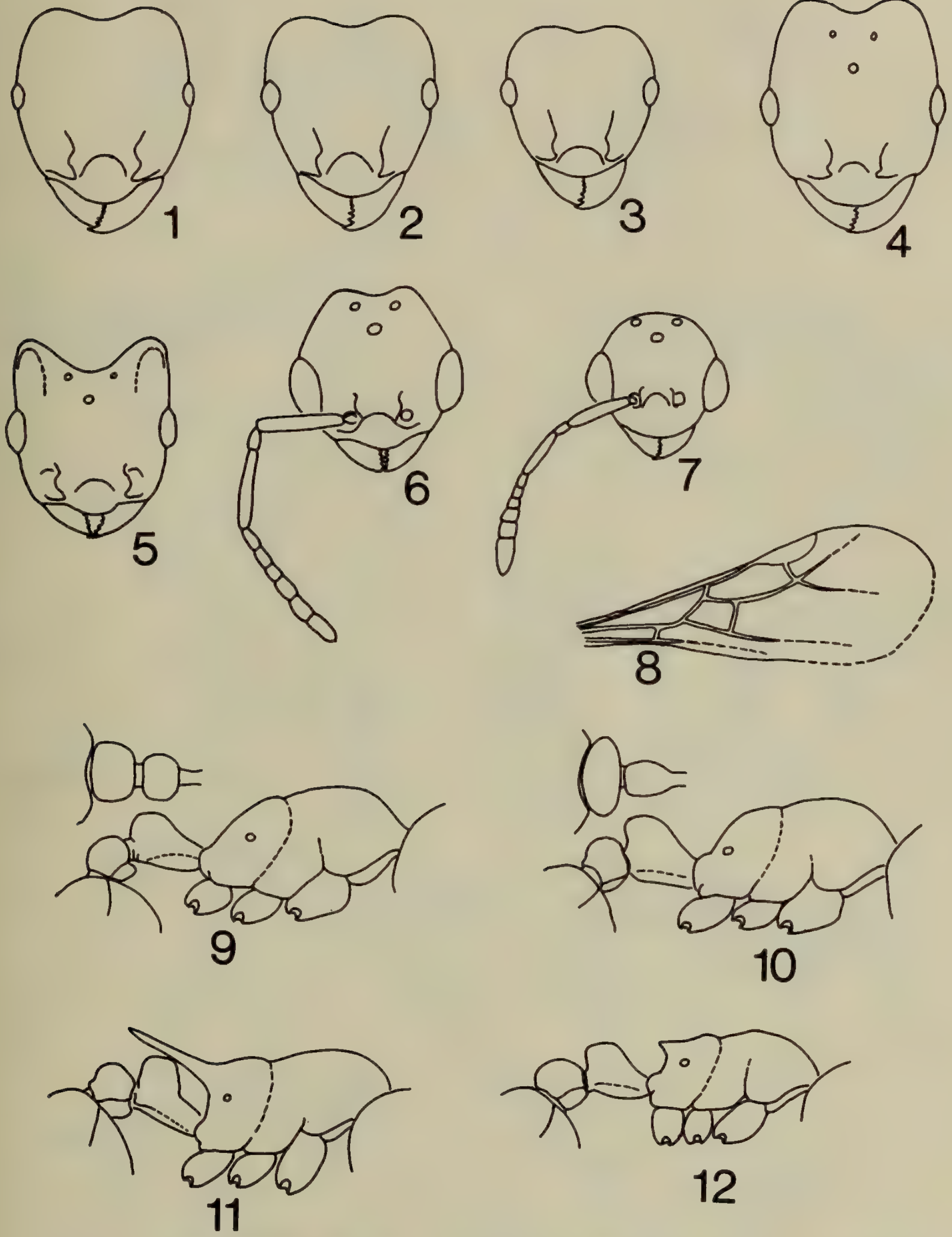
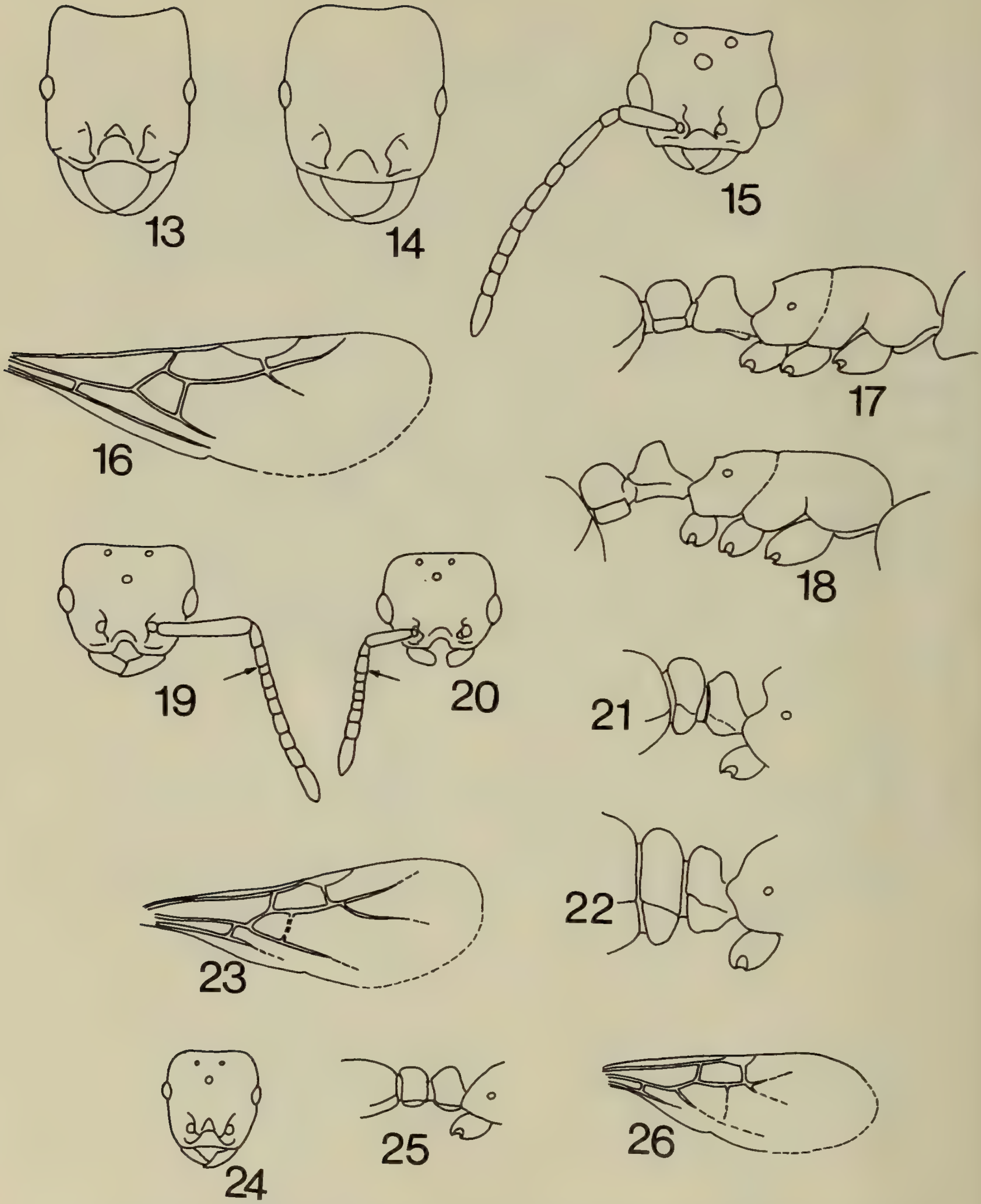


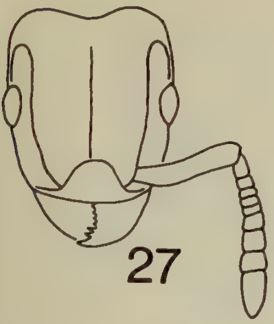
FIGS 1–12. *Rhoptromyrmex* species. 1–7. Outline of head capsule of (1) *R. globulinodis*, worker, (2) *R. melleus*, worker, (3) *R. critchleyi*, worker, (4) *R. globulinodis*, female, (5) *R. transversinodis*, female, (6) *R. globulinodis*, male, (7) *R. wroughtonii*, male. 8. Right forewing of *R. transversinodis*, male. 9–12. Outline of alitrunk and pedicel in worker of (9) *R. globulinodis* (offset shows pedicel segments in dorsal view), (10) *R. tranversinodis* (offset shows pedicel segments in dorsal view), (11) *R. melleus* (12) *R. critchleyi*.



FIGS 13–18. *Strongylognathus* species. 13–15. Outline of head capsule of (13) *S. testaceus*, worker, (14) *S. destefanii*, worker, (15) *S. testaceus*, male. 16. Right forewing of *S. testaceus*, male. 17, 18. Outline of alitrunk and pedicel in worker of (17) *S. testaceus*, (18) *S. destefanii*.

FIGS 19–23. *Anergates atratulus*. 19, outline of head of female; 20, same of male; 21, pedicel of female; 22, same of male; 23, right forewing of female.

FIGS 24–26. *Teleutomyrmex schneideri*. 24, outline of head of female; 25, outline of pedicel of female; 26, right forewing of female.



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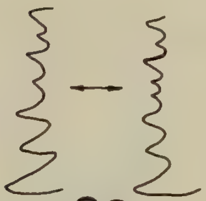

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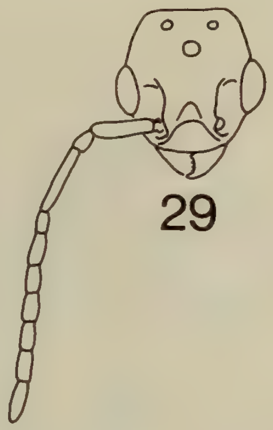

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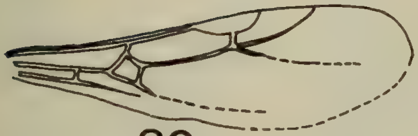

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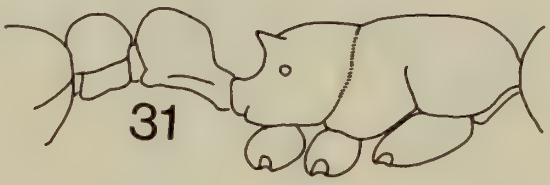

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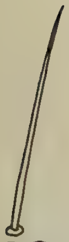

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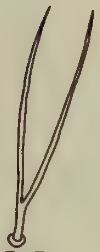

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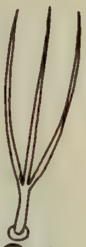

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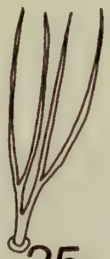

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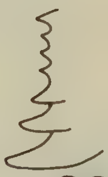

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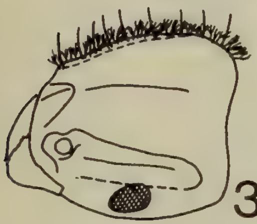

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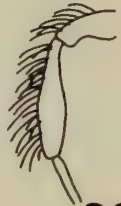

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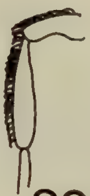

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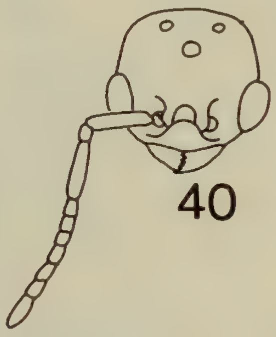

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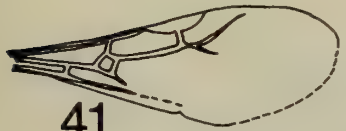

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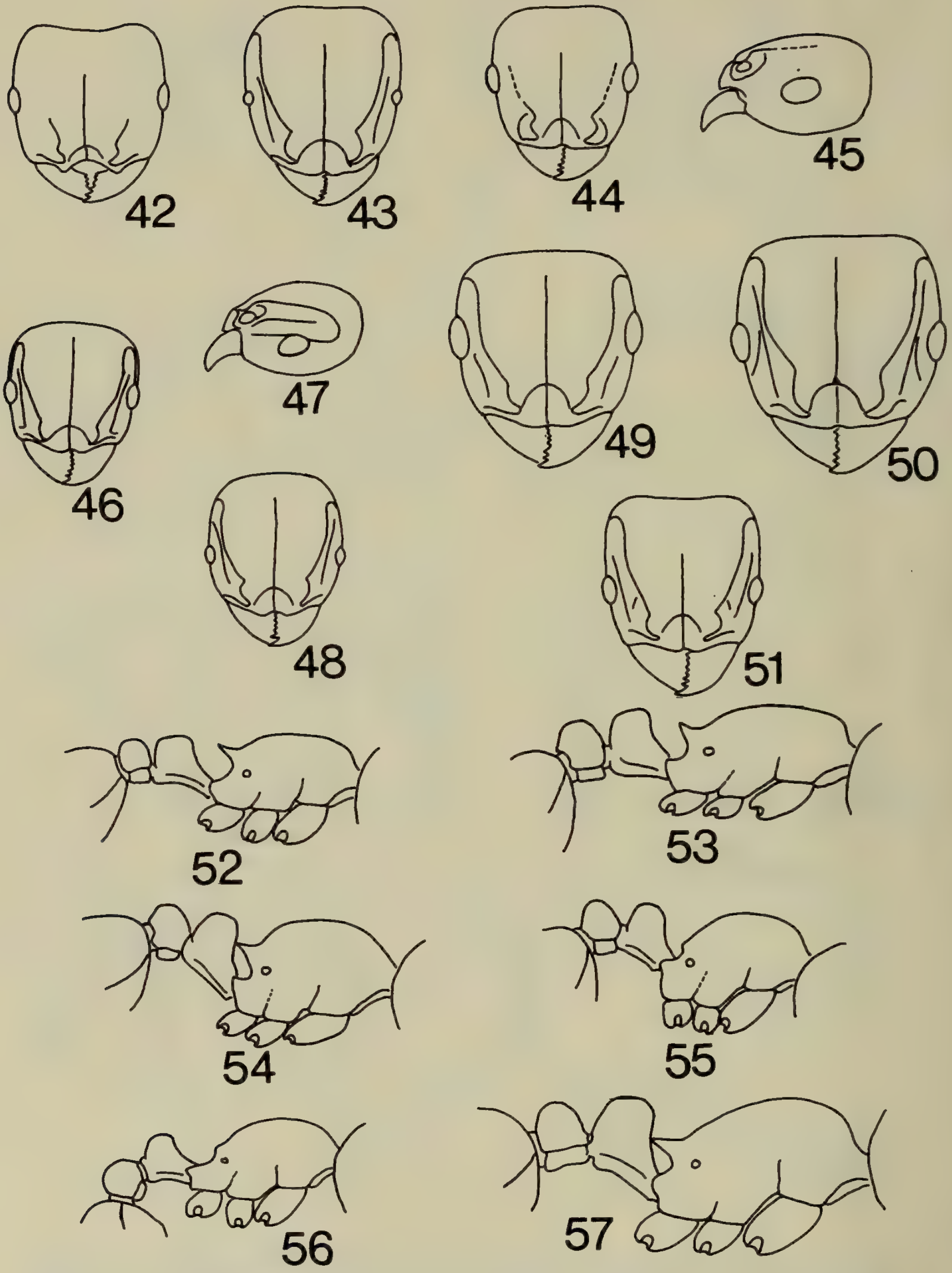
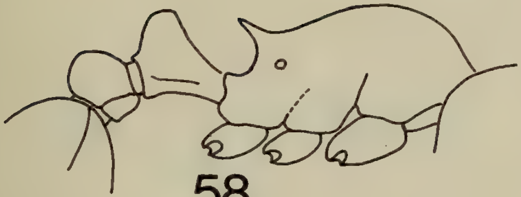
FIGS 27–31. *Decamorium decem.* 27, outline of head of worker; 28, diagram of worker mandible showing variation in denticles; 29, outline of head of male; 30, right forewing of male; 31, outline of alitrunk and pedicel of worker.

FIGS 32–41. *Triglyphothrix* species. 32–35, forms of hairs encountered in the genus; (32) simple, (33) bifid, (34) trifid, (35) quadrifid. 36, diagram of dentition mostly commonly encountered in the genus. 37, diagram of head to show row of simple long hairs on upper scrobe margins. 38, hind tibial pilosity in *T. obesa* and allies. 39, hind tibial pilosity in *T. pacifica* and allies. 40, outline of head of *T. inezulae*, male. 41, right forewing of *T. menkaura*, female.



FIGS 42–57. *Triglyphothrix* species. 42–51. Outline of heads of workers of (42) *T. rothschildi*, (43) *T. microps*, (44) *T. eminii*, (45) lateral view of *T. eminii* to show extent of scrobe, (46) *T. menkaura*, (47) lateral view of *T. menkaura* to show extent of scrobe, (48) *T. dedefra*, (49) *T. baufra*, (50) *T. brevispinosa*, (51) *T. meshena*. 52–57. Outline of alitrunk and pedicel of workers of (52) *T. rothschildi*, (53) *T. microps*, (54) *T. eminii*, (55) *T. menkaura*, (56) *T. dedefra*, (57) *T. baufra*.



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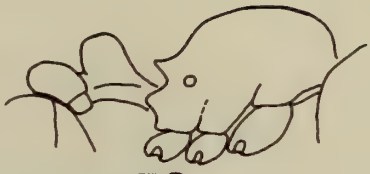

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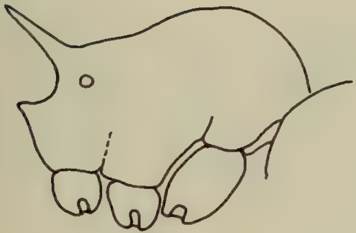

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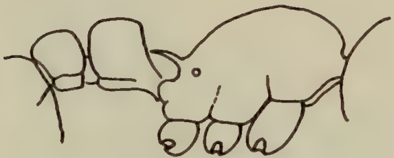

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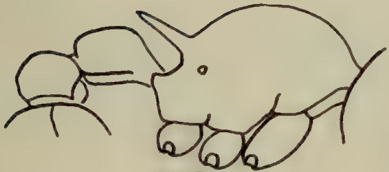

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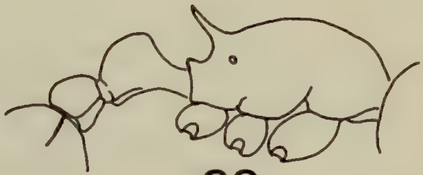

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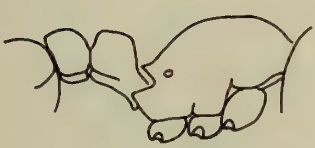

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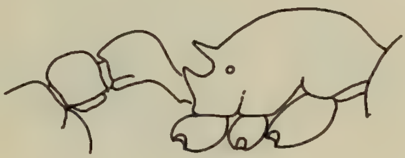

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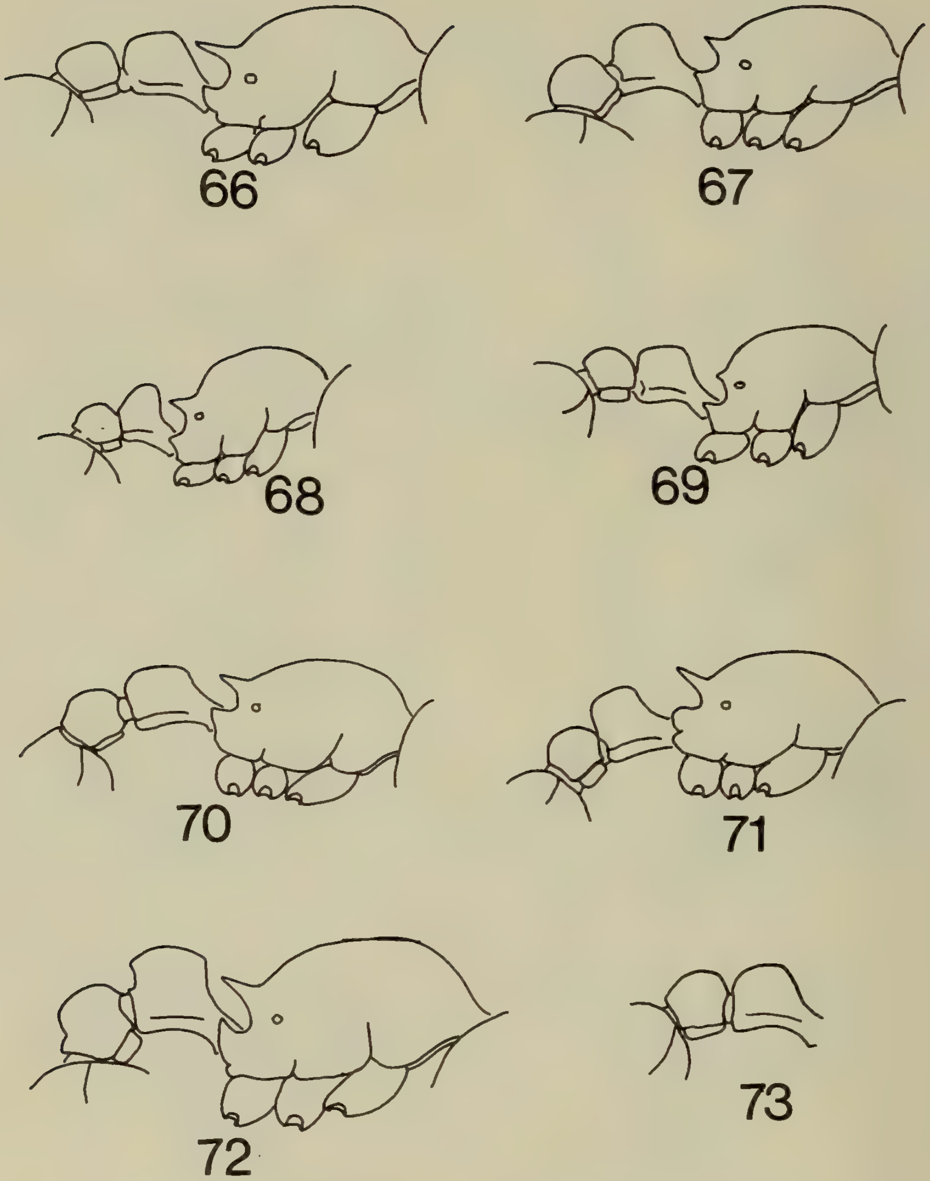
FIGS 58–65. Outline of alitrunk and pedicel in *Triglyphothrix* species, workers. 58, *T. brevispinosa*; 59, *T. pulcherrima*; 60, *T. gabonensis*; 61, *T. osiris*; 62, *T. fulviceps*; 63, *T. lanuginosa*; 64, *T. parvispina*; 65, *T. coonoorensis*.



Figs 66–73. Outline of alitrunk and pedicel in *Triglyphothrix* species, workers. 66, *T. adpressa*; 67, *T. meshena*; 68, *T. walshi*; 69, *T. brevidentata*; 70, *T. pnyxis*; 71, *T. kheperra*; 72, *T. chepocha*; 73, *T. vombis*.

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